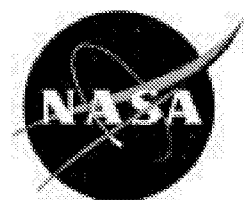


NASA/SP—2000-7011/SUPPL504
September 2000

AEROSPACE MEDICINE AND BIOLOGY

A CONTINUING BIBLIOGRAPHY WITH INDEXES



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51	Life Sciences (General)	1
	Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see <i>categories 52 through 55</i> .	
52	Aerospace Medicine	10
	Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see <i>53 Behavioral Sciences</i> . For the effects of space on animals and plants see <i>51 Life Sciences</i> .	
53	Behavioral Sciences	27
	Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.	
54	Man/System Technology and Life Support	31
	Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information <i>52 Aerospace Medicine</i> .	
55	Exobiology	39
	Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see <i>52 Aerospace Medicine</i> ; on animals and plants see <i>51 Life Sciences</i> . For psychological and behavioral effects of aerospace environments see <i>53 Behavioral Sciences</i> .	

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Typical Report Citation and Abstract

- ❶ 19970001126 NASA Langley Research Center, Hampton, VA USA
- ❷ Water Tunnel Flow Visualization Study Through Poststall of 12 Novel Planform Shapes
- ❸ Gatlin, Gregory M., NASA Langley Research Center, USA Neuhart, Dan H., Lockheed Engineering and Sciences Co., USA;
- ❹ Mar. 1996; 130p; In English
- ❺ Contract(s)/Grant(s): RTOP 505-68-70-04
- ❻ Report No(s): NASA-TM-4663; NAS 1.15:4663; L-17418; No Copyright; Avail: CASI; A07, Hardcopy; A02, Microfiche
- ❼ To determine the flow field characteristics of 12 planform geometries, a flow visualization investigation was conducted in the Langley 16- by 24-Inch Water Tunnel. Concepts studied included flat plate representations of diamond wings, twin bodies, double wings, cutout wing configurations, and serrated forebodies. The off-surface flow patterns were identified by injecting colored dyes from the model surface into the free-stream flow. These dyes generally were injected so that the localized vortical flow patterns were visualized. Photographs were obtained for angles of attack ranging from 10° to 50°, and all investigations were conducted at a test section speed of 0.25 ft per sec. Results from the investigation indicate that the formation of strong vortices on highly swept forebodies can improve poststall lift characteristics; however, the asymmetric bursting of these vortices could produce substantial control problems. A wing cutout was found to significantly alter the position of the forebody vortex on the wing by shifting the vortex inboard. Serrated forebodies were found to effectively generate multiple vortices over the configuration. Vortices from 65° swept forebody serrations tended to roll together, while vortices from 40° swept serrations were more effective in generating additional lift caused by their more independent nature.
- ❽ Author
- ❾ *Water Tunnel Tests; Flow Visualization; Flow Distribution; Free Flow; Planforms; Wing Profiles; Aerodynamic Configurations*

Key

1. Document ID Number; Corporate Source
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AEROSPACE MEDICINE AND BIOLOGY

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SEPTEMBER 2000

51

LIFE SCIENCES (GENERAL)

Includes general research topics related to plant and animal biology (non-human); ecology; microbiology; and also the origin, development, structure, and maintenance, of animals and plants in space and related environmental conditions. For specific topics in life sciences see categories 52 through 55.

20000081724 NASA Ames Research Center, Moffett Field, CA USA

An Inherited Efficiencies Model of Non-Genomic Evolution

New, Michael H., NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; Mar. 11, 1999; 6p; In English; BioMedSim '99 Conference, 20-22 Apr. 1999, Noisy-le-Grand,, France; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

A model for the evolution of biological systems in the absence of a nucleic acid-like genome is proposed and applied to model the earliest living organisms -- protocells composed of membrane encapsulated peptides. Assuming that the peptides can make and break bonds between amino acids, and bonds in non-functional peptides are more likely to be destroyed than in functional peptides, it is demonstrated that the catalytic capabilities of the system as a whole can increase. This increase is defined to be non-genomic evolution. The relationship between the proposed mechanism for evolution and recent experiments on self-replicating peptides is discussed.

Author

Efficiency; Models; Biological Evolution; Biological Diversity; Gene Expression; Protobiology; Cells (Biology)

20000083358 NASA Johnson Space Center, Houston, TX USA

Lymphocyte Functions in Space - Related Conditions

Risin, D., Wyle Labs., Inc., USA; Sundaresan, A., Wyle Labs., Inc., USA; Pellis, N. R., NASA Johnson Space Center, USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Our previous studies showed that modeled (MMG) and true (STS-54 and STS-56) microgravity (MG) inhibit human lymphocyte locomotion. MMG also suppresses polyclonal and antigen-specific lymphocyte activation. Analysis of the relationship between activation deficits and the loss of locomotion in MG suggested a fundamental defect in signal transduction mechanism localized either at the PKC level or upstream at the cell membrane. FACS analysis of the expression of PKC isoforms in PBMC revealed that MMG selectively inhibits the PKC isoforms expression. The decrease was most prominent in PKC epsilon, less obvious in PKC delta and almost marginal and insignificant in PKC alpha. Western blot analysis confirmed these results (PKC epsilon protein expression was downregulated at 24, 72 and 96 hours in MG). We also found a decrease in PKC epsilon mRNA expression. MMG inhibited programmed cell death (PCD) in lymphocytes. Inhibition was observed in two types of experiments: 1) when PCD was induced by gamma-radiation of PBMC, and 2) when PCD in activated T cells was triggered by PHA-M or PMA + ionomycin restimulation. The established direct effects of MG on signal transduction mechanisms as well as on PCD in lymphocytes could contribute to the impairment of the immunity in space.

Author

Lymphocytes; Activation (Biology); Locomotion; Genetics; Gene Expression; Ribonucleic Acids

20000083582 Korean Atomic Energy Research Inst., Taejon, Korea, Republic of

Study on technology for minimizing radiation risk

Lee, J. H.; Kim, I. G.; Kim, J. K.; Lee, K. S.; Kim, K. C.; Jan. 31, 1997; 19p; In Korean; In English
Report No.(s): DE98-607790; KAERI/RR-1676/96; No Copyright; Avail: Department of Energy Information Bridge

Apoptosis, also called programmed cell death to discriminate it from necrosis, is characterized by : chromatin condensation, apoptotic body formation, fragmentation of DNA into oligonucleosome sized pieces, swelling and progressive cell degradation. We examined morphological and biochemical changes of T-lymphocytes following gamma irradiation exposure. The results are followings. (1) Murine lymphocytes have several characteristics : The irradiated cells undergo morphological and biochemical changes characteristic of apoptosis, causing growth delay. (0.01, 0.1, 1.0 Gy) (2) The onset of DNA fragmentation in cells occurs after one more cell divisions. (3) DNA fragmentation in cells occurs in all irradiated group (0.1, 1.0, 2.0, 4.0 Gy, 24 hours following gamma radiation exposure) (4) Apoptotic bodies were detected by confocal microscope with ease when compared with electron microscope. For the developing technology for minimizing radiation damage, the following experimental works have been done. (1) Establishment of experimental system for pre-screening of radioprotectants - Screening of protective substances using TSH bioindicator - Efficacy test of some radioprotective materials (2) TSH bioindicator system can make a scientific role in screening unknown materials for their possible radioprotective effect.

NTIS

Radiation Protection; Radiation Damage; Radiation Dosage

20000083906 Institute of Space Medico-Engineering, Beijing, China

Mechanism of Pineal and Suprachiasmatic Regulation on circadian Rhythm of Body Temperature in Rats

Tong, Jian, Institute of Space Medico-Engineering, China; Qin, Li-Qiang, Institute of Space Medico-Engineering, China; Wang, Dao-Jin, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 101-103; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To investigate the mechanism of circadian rhythm of skin and core temperature as regulated by pineal and suprachiasmatic nucleus (SCN) in rats. Pineal destruction and melatonin interference test were employed. The two nuclei functioned differently in the maintenance of the temperature rhythm. Changes of the temperature level were nucleus related, i. e., up-regulated by pineal and down regulated by SCN. In terms of initiation and daily running of the rhythmic oscillation, pineal is probably the central clock of the skin temperature rhythm, while SCN mainly controls the core temperature rhythm. The two nuclei interlink by way of neuroendocrine signals to balance over the oscillatory system of the circadian temperature.

Author

Body Temperature; Circadian Rhythms; Rats; Pineal Gland; Aerospace Medicine; Chiasms

20000083919 International Atomic Energy Agency, Vienna Austria

Health effects and medical surveillance

Jun. 30, 1998; 68p; In English

Report No.(s): DE99-613930; IAEA-PRTM-3; No Copyright; Avail: Department of Energy Information Bridge, Microfiche

Source of ionizing radiations have innumerable applications in the work place. Usually, even where the work is performed safely, the employees involved inevitably receive small, regular exposures to radiation that are not manifestly harmful. This Module explains how ionizing radiations can interact with and affect human tissues, the various factors that influence the outcome and the detrimental effects that may result. The medical surveillance that is appropriate for those working with radiation sources, depending on the degree of hazard of the work, is described. The Manual will be of most benefit if it forms part of more comprehensive training or is supplemented by the advice of a medically qualified expert. Where medical surveillance is appropriate for radiation employees, the services of a qualified doctor, occupational physician or other trained medical staff will be required.

NTIS

Health; Surveillance; Radiation Sources; Radiation Protection

20000083952 Institute of Space Medico-Engineering, Beijing, China

C-fos Expression in Rat's Vestibular Nucleus Under Eccentric Rotational Stimulation

Liu, Zhi-Qiang, Institute of Space Medico-Engineering, China; Pei, Jing-Chen, Institute of Space Medico-Engineering, China; Wang, Lin-Jie, Institute of Space Medico-Engineering, China; Huang, Zeng-Ming, Institute of Space Medico-Engineering, China; Tong, Bo-Lun, Institute of Space Medico-Engineering, China; Gu, Hua-Guang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 132-135; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To investigate the c-fos expression in rat's vestibular nucleus under eccentric rotational stimulation and the effects of anti-motion sickness drug(PAPM) on this expression. 19 SD rats were divided into three groups: A, B and C. A received as control. B was stimulated by eccentric rotation for 60 minutes. C received injection of PAPM through cavun abdominis 45 min before eccentric rotation. Immunohistochemical method and computerized image analysis were used to map locations of c-fos protein

appeared in four vestibular nucleus and to count the masculine cells. C-fos protein appeared in four vestibular nucleus areas after stimulation, and PAPM had no influence on this expression. It suggests that c-fos expression in vestibular nucleus is one of the important way in which vestibular nervous system reacts to outside stimulation and this expression has no direct relationship with the generation and development of motion sickness.

Author

Rats; Gene Expression; Vestibules; Aerospace Medicine; Eccentricity; Stimulation; Rotation

20000084129 Institute of Space Medico-Engineering, Beijing, China

Effects of Space Conditions on Mutation and Inheritance of Tomato

Li, Jin-Guo, Institute of Space Medico-Engineering, China; Liu, Min, Institute of Space Medico-Engineering, China; Wang, Pei-Sheng, Institute of Space Medico-Engineering, China; Zhang, Jian, Institute of Space Medico-Engineering, China; Xue, Huai, Institute of Space Medico-Engineering, China; Guo, Ya-Hua, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 114-118; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To study the effects of space conditions on mutation and inheritance of tomato. Air-dried seeds of tomato were carried by a satellite for 7 to approximately 15 d. These seeds were planted after returning. The mutagenic effects of space conditions on some of their variations of the botanical characteristics were studied. Tomato dry seeds were carried to the outer space by satellite. After returned to the earth it was found that SP1 generation was of their germination percentage lower than the control. This physiological damage returned to normal in SP2 generation. Seeding isoenzyme, plant growth, resistance, and output, showed variation, and profitable variation had been expressed in later generations. The characters were expressed in the progenies. By observation and screen, promising line of tomato TF873, was obtained. It was suggested that space conditions induce profitable mutation of crop and it is a possible way for plant mutation breeding.

Author

Mutations; Tomatoes; Aerospace Environments; Exobiology; Genetics

20000084155 NASA Johnson Space Center, Houston, TX USA

T Lymphocyte Activation Threshold is Increased in Reduced Gravity

Adams, Charley L., NASA Johnson Space Center, USA; Gonzalez, M., NASA Johnson Space Center, USA; Sams, C. F., NASA Johnson Space Center, USA; [2000]; 5p; In English, 28 Jan. - 3 Feb. 2000, Keystone, CO, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

There have been substantial advances in molecular and cellular biology that have provided new insight into the biochemical and genetic basis of lymphocyte recognition, activation and expression of distinct functional phenotypes. It has now become evident that for both T and B cells, stimuli delivered through their receptors can result in either clonal expansion or apoptosis. In the case of T cells, clonal expansion of helper cells is accompanied by differentiation into two major functional subsets which regulate the immune response. The pathways between the membrane and the nucleus and their molecular components are an area of very active investigation. This meeting will draw together scientists working on diverse aspects of this problem, including receptor ligand interactions, intracellular pathways that transmit receptor mediated signals and the effect of such signal transduction pathways on gene regulation. The aim of this meeting is to integrate the information from these various experimental approaches into a new synthesis and molecular explanation of T cell activation, differentiation and death.

Author

Lymphocytes; Activation (Biology); Molecular Biology; Genetics; Gene Expression; Biological Evolution

20000084156 NASA Johnson Space Center, Houston, TX USA

Growth of Streptomyces Hygroscopicus in Rotating-Wall Bioreactor Under Simulated Microgravity Inhibits Rapamycin Production

Fang, A., Massachusetts Inst. of Tech., USA; Pierson, D. L., NASA Johnson Space Center, USA; Mishra, S. K., Universities Space Research Association, USA; Demain, A. L., Massachusetts Inst. of Tech., USA; [2000]; 11p; In English
Contract(s)/Grant(s): NAG9-602; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Growth of Streptomyces hygroscopicus under conditions of simulated microgravity in a rotating-wall bioreactor resulted in a pellet form of growth, lowered dry cell weight, and inhibition of rapamycin production. With the addition of Teflon beads to the bioreactor, growth became much less pelleted, dry cell weight increased but rapamycin production was still markedly

inhibited. Growth under simulated microgravity favored extracellular production of rapamycin in contrast to a greater percentage of cell-bound rapamycin observed under normal gravity conditions.

Author

Streptomyces; Hygroscopicity; Biosynthesis; Microgravity

20000084337 NASA Johnson Space Center, Houston, TX USA

Population of Nitrifying Bacteria and Nitrification in Ammonium Saturated Clinoptilolite

McGilloway, R. L., Texas A&M Univ., USA; Weaver, R. W., Texas A&M Univ., USA; Ming, Douglas W., NASA Johnson Space Center, USA; Gruener, J., NASA Johnson Space Center, USA; [1999]; 1p; In English; Science Serving Agriculture and Natural Resources: Past/Present, 30 Oct. - 4 Nov. 1999, Salt Lake City, UT, USA; Sponsored by American Society of Agronomy, USA Contract(s)/Grant(s): RTOP 131-50-20-23; No Copyright; Avail: Issuing Activity; Abstract Only

As humans begin to spend longer periods of time in space, plants will be incorporated into life support systems. Ammonium saturated clinoptilolite is one plant growth substrate but a balance between ammonium and nitrate is needed. A laboratory study was conducted to determine effects of nitrifying bacteria on ammonium concentrations and kinetics of nitrification. Columns containing clinoptilolite substrate amended with nitrifying bacteria obtained from soil enrichment were analyzed weekly for a 90 day period. The enrichment culture initially contained 1×10^5 (exp 5) ammonium oxidizing bacteria and 1×10^2 (exp 2) nitrite oxidizing bacteria per gram of substrate. Populations of ammonium oxidizing bacteria increased to 1×10^6 (exp 6) and nitrite oxidizing bacteria increased to 1×10^3 (exp 3) per gram of substrate. The nitrification rate was approximately 0.25mg NO₃(-)-N/kg.hr. Experiments were also conducted to enumerate nitrifying bacteria in a clinoptilolite substrate used to grow wheat (*Triticum aestivum* L.). Seventy days following the initial inoculation with an unknown number of commercial nitrifying bacteria, 1×10^5 (exp 5) ammonium oxidizing bacteria per gram of substrate were present. The number of nitrite oxidizing bacteria was between 1×10^3 (exp 3) to 10^4 (exp 4) per gram of substrate as measured by the most probable number method. Nitrification rates were approximately 0.20mg NO₃(-)-N/kg.hr. Clinoptilolite readily exchanged sufficient concentrations of ammonium to support nitrifying bacteria and they survived well in this medium.

Author

Nitration; Denitrogenation; Ammonium Compounds; Nitrites; Oxidation; Nitric Acid; Zeolites; Minerals

20000085588 International Atomic Energy Agency, Vienna Austria

Low doses of ionizing radiation: Biological effects and regulatory control. Contributed papers

Nov. 30, 1997; 711p; In English; Low doses of ionizing radiation: biological effects and regulatory control

Report No.(s): DE98-618151; IAEA-TECDOC-976; No Copyright; Avail: Department of Energy Information Bridge

The International Atomic Energy Agency and the World Health Organization, in cooperation with the United Nations Scientific Committee on the Effects of Atomic Radiation, organized an international conference on Low Doses of Ionizing Radiation: Biological Effects and Regulatory Control, held in seville, Spain, from 17 to 21 November 1997. This technical document contains concise papers submitted to the conference.

NTIS

Biological Effects; Regulations; Conferences; Ionizing Radiation; Radiation Effects

20000085891 NASA Johnson Space Center, Houston, TX USA

Decreased NK-Cell Cytotoxicity after Short Flights on the Space Shuttle

Mehta, Satish K., Enterprise Advisory Services, Inc., USA; Grimm, Elizabeth A., Texas Univ. Health Science Center, USA; Smid, Christine, Texas Univ. Health Science Center, USA; Kaur, Indreshpal, Enterprise Advisory Services, Inc., USA; Feeback, Daniel L., NASA Johnson Space Center, USA; Pierson, Duane L., NASA Johnson Space Center, USA; [2000]; 25p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Cytotoxic activity of natural killer (NK) cells and cell surface marker expression of peripheral blood mononuclear cells (PBMcs) isolated from 11 U.S. astronauts on two different missions were determined before and after 9 or 10 days of spaceflight aboard the space shuttle. Blood samples were collected 10 and 3 days before launch, within 3 hours after landing, and 3 days after landing. All PBMc preparations were cryopreserved and analyzed simultaneously in a 4-hour cytotoxicity ⁵¹Cr-release assay using NK-sensitive K-562 target cells. Compared to preflight values, NK-cell cytotoxicity (corrected for lymphopenia observed on landing day) was significantly decreased at landing (P is less than 0.0125). It then apparently began to recover and approached preflight values by 3 days after landing. Consistent with decreased NK-cell cytotoxicity, significant increases from preflight values were found in plasma adrenocorticotrophic hormone at landing. Plasma and urinary cortisol levels did not change significantly from preflight values. Expression of major lymphocyte surface markers (CD3, CD4, CD8, CD14, CD16, CD56),

determined by flow cytometric analysis, revealed no consistent phenotypic changes in relative percent of NK or other lymphoid cells after 10 days of spaceflight.

Author

Toxins and Antitoxins; Plasmas (Physics); Cells (Biology); Blood; Cytometry

20000085927 NASA Johnson Space Center, Houston, TX USA

A Survey of Environmental Microbial Flora During Closed Chamber Studies

Ott, C. Mark, Enterprise Advisory Services, Inc., USA; Groves, Theron O., Enterprise Advisory Services, Inc., USA; Bell-Robinson, Denetia, Enterprise Advisory Services, Inc., USA; Pierson, Duane L., NASA Johnson Space Center, USA; [1999]; 1p; In English, 1-6 Aug. 1999, Arlington, VA, USA; Sponsored by Society for Industrial Microbiology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Services, Inc. and NASA Johnson Space Center, Houston, TX As NASA prepares for long-term missions aboard the International Space Station and the eventual exploration of Mars, closed-environment chambers on Earth have become important test beds for systems evaluations. During 2 separate studies of a self-contained ecosystem containing 4 crewmembers, microbial surveys of samples from 13 surface and 3 air sites were performed. Microbial concentration of samples from surface sites with frequent water contact (e.g., urinal, sink) did not indicate significantly higher levels of contamination than drier areas, though surface cleaning by the crew may have influenced this conclusion. Changes in bacterial diversity on surface sites implied that the number of transient species was high, suggesting movement by crew activities, aerosols, or both. A non-linear relationship between bacterial diversity and enumeration from surface samples indicated that a rapid increase occurred in the number of species as cell concentration increased to 5 CFU/sq cm. Above this concentration, the number of different bacterial species varied between 11 and 16. Airborne bacteria and fungi averaged only 160 and 1 CFU/m³, respectively. Microbial contamination of the potable water system primarily consisted of 3 species of Gram negative bacteria; however, after 60 days during one study, several species of *Bacillus* became the dominant flora. This study suggests that under these conditions, microbial contamination in the air and water was suppressed by the life-support systems, though contamination was possible. Conversely, the crew and their activities controlled microbial levels on surfaces. Understanding the factors that affect microbial control will improve the design of microbial testing both during space flight and in analogous Earth-based environments.

Author

Test Chambers; Surveys; Potable Water; Plants (Botany); Microorganisms; Control Surfaces; Atmospheric Chemistry

20000085928 Wyle Labs., Inc., Wyle Life Sciences, Systems and Services, Houston, TX USA

Locomotion in Lymphocytes is Altered by Differential PKC Isoform Expression

Sundaresan, A., Wyle Labs., Inc., USA; Risin, D., Wyle Labs., Inc., USA; Pellis, N. R., NASA Johnson Space Center, USA; [1999]; 1p; In English; 39th; Cell Biology Meeting, 11-15 Dec. 1999, Washington, DC, USA; Sponsored by American Society for Cell Biology, USA

Contract(s)/Grant(s): NAG5-4072; No Copyright; Avail: Issuing Activity; Abstract Only

Lymphocyte locomotion is critical for proper elicitation of the immune response. Locomotion of immune cells via the interstitium is essential for optimal immune function during wound healing, inflammation and infection. There are conditions which alter lymphocyte locomotion and one of them is spaceflight. Lymphocyte locomotion is severely inhibited in true spaceflight (true microgravity) and in rotating wall vessel culture (modeled microgravity). When lymphocytes are activated prior to culture in modeled microgravity, locomotion is not inhibited and the levels are comparable to those of static cultured lymphocytes. When a phorbol ester (PMA) is used in modeled microgravity, lymphocyte locomotion is restored by 87%. This occurs regardless if PMA is added after culture in the rotating wall vessel or during culture. Inhibition of DNA synthesis also does not alter restoration of lymphocyte locomotion by PMA. PMA is a direct activator of (protein kinase C) PKC. When a calcium ionophore, ionomycin is used it does not possess any restorative properties towards locomotion either alone or collectively with PMA. Since PMA brings about restoration without help from calcium ionophores (ionomycin), it is inferred that calcium independent PKC isoforms are involved. Changes were perceived in the protein levels of PKC δ where levels of the protein were downregulated at 24, 72 and 96 hours in untreated rotated cultures (modeled microgravity) compared to untreated static (1g) cultures. At 48 hours there is an increase in the levels of PKC ϵ in the same experimental set up. Studies on transcriptional and translational patterns of calcium independent isoforms of PKC such as δ and ϵ are presented in this study.

Author

Lymphocytes; Locomotion; Esters; Infectious Diseases; Physiological Responses

20000085929 NASA Johnson Space Center, Houston, TX USA

Cell Culture in Microgravity: Opening the Door to Space Cell Biology

Pellis, Neal R., NASA Johnson Space Center, USA; [1999]; 1p; In English; 50th; SIM 50th Anniversary Annual Meeting, 1-6 Aug. 1999, Arlington, VA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Adaptational response of human cell populations to microgravity is investigated using simulation, short-term Shuttle experiments, and long-term microgravity. Simulation consists of a clinostatically-rotated cell culture system. The system is a horizontally-rotated cylinder completely filled with culture medium. Low speed rotation results in continuous-fall of the cells through the fluid medium. In this setting, cells: 1) aggregate, 2) propagate in three dimensions, 3) synthesize matrix, 4) differentiate, and 5) form sinusoids that facilitate mass transfer. Space cell culture is conducted in flight bioreactors and in static incubators. Cells grown in microgravity are: bovine cartilage, promyelocytic leukemia, kidney proximal tubule cells, adrenal medulla, breast and colon cancer, and endothelium. Cells were cultured in space to test specific hypotheses. Cartilage cells were used to determine structural differences in cartilage grown in space compared to ground-based bioreactors. Results from a 130-day experiment on Mir revealed that cartilage grown in space was substantially more compressible due to insufficient glycosaminoglycan in the matrix. Interestingly, earth-grown cartilage conformed better to the dimensions of the scaffolding material, while the Mir specimens were spherical. The other cell populations are currently being analyzed for cell surface properties, gene expression, and differentiation. Results suggest that some cells spontaneously differentiate in microgravity. Additionally, vast changes in gene expression may occur in response to microgravity. In conclusion, the transition to microgravity may constitute a physical perturbation in cells resulting in unique gene expressions, the consequences of which may be useful in tissue engineering, disease modeling, and space cell biology.

Author

Adrenal Gland; Cells (Biology); Culture Techniques; Exobiology; Mass Transfer; Microgravity

20000085931 NASA Johnson Space Center, Houston, TX USA

Volatiles Evolved from Soybean Products Intended for Use in Long Duration Space Missions

Vodovotz, Yael, Houston Univ., USA; Bourland, Charles T., NASA Johnson Space Center, USA; [1999]; 1p; In English; Institute of Food Technologists Annual Convention, 24-29 Jul. 1999, Chicago, IL, USA; Sponsored by Institute of Food Technologists, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Soybeans have been baselined to be grown in a habitat (Advanced Life Support Systems Integration Test Bed, ALSSITB) intended for evaluating advanced life support systems developed for long duration missions to the Moon or Mars. The ALSSITB is being constructed at NASA-Johnson Space Center and is composed of 5 chambers (4.6 m x 11.3 m each) and an airlock joined by an interconnecting tunnel (3.7 m x 19.2 m). Processed soy products such as soy milk and soy bread are planned to be incorporated into a nutritionally sound, plant-based food system. Since all consumables will be recycled and reused, volatile compounds evolved during the manufacturing of these food products need to be quantified to assess their impact on this closed loop system. Soy milk was made in a prototype machine and bread in a commercial bread baking machine. These machines were each placed in a tightly closed chamber and, at the completion of the process, air volatiles were identified and quantified by GC/MS. For soy milk, ethanol, acetaldehyde, methanol, hexanal, propanal and acetone and for soybread, acetaldehyde, ethanol, N-propanol and ethyl acetate were detected in significant quantities. The crew members will spend an average of 180 days in the ALSSITB and it was estimated that 138 batches of soy milk will be processed in the tunnel and 130 loaves of soybread would be baked in the habitat chamber during their stay. The aforementioned volatiles would surpass the 180 day Spacecraft Maximum Allowable Concentrations (SMACs) if no means of scrubbing are adapted which would lead to toxic levels of these compounds. Therefore, sufficient means for eliminating the contribution of volatiles evolved from food processing and preparation equipment needs to be provided in the ALSSITB.

Author

Consumables (Spacecraft); Crews; Feedback Control; Food Processing; Life Support Systems; Soybeans; Prototypes

20000086228 NASA Johnson Space Center, Houston, TX USA

Modeled Microgravity Inhibits Apoptosis in Peripheral Blood Lymphocytes

Risin, Diana, Wyle Labs., Inc., USA; Pellis, Neal R., NASA Johnson Space Center, USA; [1999]; 21p; In English; Low Gravity Research, 28 Feb. - 3 Mar. 1999, Rome, Italy; Sponsored by European Low-Gravity Research Association, Unknown; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Impairment of the immunity in astronauts and cosmonauts even in short term flights is a recognized risk. Long term orbital space missions and anticipated interplanetary flights increase the concern for more pronounced effects on the immune system with potential clinical consequences. Impairment of the immunity in space may be due to numerous physiological changes caused by space-related factors, which in turn affect the immune system, or alternatively, it may be due to direct effects of different factors

encountered in space on lymphoid cells and their interactions. Indeed, in modeled microgravity (MMG) experiments on Earth we and others showed that microgravity directly affects multiple lymphocyte functions. It interferes with expression of cell surface molecules, causes inhibition of lymphocyte locomotion, suppresses polyclonal and antigen-specific lymphocyte activation, selectively inhibits protein kinase C (PKC) isoforms. Some of these effects were also confirmed in cell culture experiments in real space conditions during Spacelab, Biokosmos and Shuttle Missions. The results of these studies, taken together, strongly indicated that microgravity interferes with fundamental biological processes associated with functional and structural changes in cell surface membranes, cell surface molecules and in their interaction. Based on the data and on their interpretation, we hypothesized that microgravity in addition to observed functional changes affects programmed cell death (PCD) in lymphocyte populations and that this mechanism could contribute to the impairment of the immunity.

Derived from text

Lymphocytes; Blood; Cells (Biology); Microgravity; Gravitational Effects; Activation (Biology)

20000089705 NASA Langley Research Center, Hampton, VA USA

Animal trials of a Magnetically Levitated Left-Ventricular Assist Device

Paden, Brad, California Univ., USA; Antaki, James, Pittsburgh Univ., USA; Groom, Nelson, NASA Langley Research Center, USA; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 251-258; In English; See also 20000089691; No Copyright; Avail: CASI; A02, Hardcopy; A06, Microfiche

The University of Pittsburgh/Magnetic Moments mag-lev left-ventricular assist devices (LVADs), the Streamliner HG3b and HG3c, have successfully been implanted in calves. The first was implanted for 4 hours on July 10, 1998 and the second for 34 days on August 24, 1999 respectively. The tests confirmed the feasibility of low power levitation (1.5 watts coil power) and very low blood damage in a mag-lev ventricular assist device. In this paper, we describe the unique geometry of this pump and its design. Key features of this LVAD concept are the passive radial suspension and active voice-coil thrust bearing.

Author

Implantation; Calves; Levitation; Cardiac Ventricles; Magnetic Moments; Medical Equipment; Heart Function

20000090507 Institute of Nuclear Chemistry and Technology, Warsaw, Poland

Investigation the effect of ionizing radiation on the level of microbial contamination and usefulness of selected raw materials and cosmetics of new generation

Migdal, W.; Owczarczyk, H. B.; Malec-Czechowska, K.; Dec. 31, 1997; 15p; In Polish; In English

Report No.(s): DE98-616902; INCT-18/B/96; No Copyright; Avail: Department of Energy Information Bridge

The results of investigations the electron beam irradiation on the microbial contamination of selected new generation cosmetics and raw products used in cosmetic industry are reported. The radiation doses applied were not higher than 6.0 kGy. The levels of microbial contamination were determined in irradiated and non-irradiated samples by standard methods routinely used. The results obtained show that radiation can be successfully used for decontamination of cosmetics and some of their raw materials, without changing the quality and applicability of the product.

NTIS

Ionization; Irradiation; Radiation Effects; Microorganisms; Dosage

20000090564 NASA Johnson Space Center, Houston, TX USA

Zeoponic Plant Growth Substrate Development at the Johnson Space Center and Possible Use at a Martian Outpost

Gruener, John E., Hernandez Engineering, Inc., USA; Ming, Douglas W., NASA Johnson Space Center, USA; [2000]; 7p; In English; 7th; Engineering, Construction, Operations and Business in Space, 28 Feb. - 2 Mar. 2000, Albuquerque, NM, USA; Sponsored by American Society of Civil Engineers, USA

Contract(s)/Grant(s): RTOP 131-50-20-23; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) Johnson Space Center (JSC) is developing a substrate, termed zeoponics, that will slowly release all of the essential nutrients into solution for plant growth experiments in advanced life support system testbeds. This substrate is also potentially useful in the near future on the Space Shuttle and International Space Station and could eventually be used at an outpost on Mars. Chemical analyses of the Martian soil by the Viking and Mars Pathfinder missions have indicated that several of the elements required for plant growth are available in the soil. It may be possible to use the martian soil as the bulk substrate for growing food crops, while using smaller amounts of zeoponic substrate as an amendment to rectify any nutrient deficiencies.

Author

Substrates; Vegetation Growth; Life Support Systems; Zeolites; Mars Surface; Mars (Planet)

20000090586 Commissariat a l'Energie Atomique, Dept. de Protection de la Sante de l'Homme et de Dosimetrie, Fontenay-aux-Roses, France

Uranium chemistry in blood and aqueous media. Techniques of studies

Scapolan, S.; Nov. 30, 1996; 115p; In French; In English

Report No.(s): DE98-617512; CEA-DPHD-96-02; No Copyright; Avail: Department of Energy Information Bridge

The object of this report in a first step, is to understand the chemistry of uranium in aqueous phase by specifying the behavior of this element in function of several parameters such PH, concentration of present species, temperature, ionic force. In a second step, investigation techniques are reviewed: X rays diffraction, potentiometric titrations, polarography, spectrophotometry, NMR of C-13, P-31, O-17, capillary electrophoresis, laser detection. The third part brings elements to understand the uranium complexation in blood medium.

NTIS

Blood; Uranium; Detection; Diffraction; Spectrophotometry

20000091002 NASA Ames Research Center, Moffett Field, CA USA

Computer Simulation Studies of Ion Channel Gating: Characteristics of the M2 Channel of Influenza-A Virus in a Phospholipid Bilayer

Schweighofer, Karl J., NASA Ames Research Center, USA; Pohorille, Andrew, NASA Ames Research Center, USA; [1999]; 55p; In English

Contract(s)/Grant(s): RTOP 344-38-22; No Copyright; Avail: CASI; A04, Hardcopy; A01, Microfiche

The 25 amino acids long, transmembrane fragment of the Influenza virus M2 protein forms a homotetrameric channel that transports protons across lipid bilayers. It has been postulated that high efficiency and selectivity of this process is due to gating by four histidine residues that occlude the channel lumen in the closed state. Two mechanisms of gating have been postulated. In one mechanism, the proton is "shuttled" through the gate by attaching to the delta nitrogen atom on the extracellular side of the imidazole ring, followed by the release of the proton attached to the epsilon nitrogen atom on the opposite side. In the second mechanism, the four histidines move away from each other due to electrostatic repulsion upon protonation, thus opening the gate sufficiently that a wire of water molecules can penetrate the gate. Then, protons are transported by "hopping" along the wire. In this paper, both mechanisms are evaluated in a series of molecular dynamics simulations by investigating stability of different protonation states of the channel that are involved in these mechanisms. For the shuttle mechanism, these are states with all epsilon protonated histidines, one biprotonated residue or one histidine protonated in the delta position. For the gate opening mechanism, this is the state in which all four histidines are biprotonated. In addition, a state with two biprotonated histidines is considered. For each system, composed of the protein channel embedded in phospholipid bilayer located between two water lamellae, a molecular dynamics trajectory of approximately 1.3 ns (after equilibration) was obtained. It is found that the states involved in the shuttle mechanism are stable during the simulations. Furthermore, the orientations and dynamics of water molecules near the gate are conducive to proton transfers involved in the shuttle. In contract, the fully biprotonated state, implicated in the gate opening mechanism, is not stable and the channel loses its structural integrity. If only two histidines are biprotonated the channel deforms but remains intact with the gate mostly closed. In summary, the results of this study lend support to the shuttle mechanism but not to the gate opening mechanism of proton gating in M2.

Author

Histidine; Lipids; Proteins; Influenza; Viruses

20000091532 NASA Johnson Space Center, Houston, TX USA

Suppression of Antigen-Specific Lymphocyte Activation in Simulated Microgravity

Cooper, David, Texas Univ. Health Science Center, USA; Pride, Michael W., Texas Univ., USA; Brown, Eric L., Texas Univ., USA; Risin, Diana, Wyle Labs., Inc., USA; Pellis, Neal R., NASA Johnson Space Center, USA; [1999]; 15p; In English

Contract(s)/Grant(s): NAG5-4072; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Various parameters of immune suppression are observed in astronauts during and after spaceflight, and in isolated immune cells in true and simulated microgravity. Specifically, polyclonal activation of T cells is severely suppressed in true and simulated microgravity. These recent findings with various polyclonal activators suggests a suppression of oligoclonal lymphocyte activation in microgravity. We utilized rotating wall vessel (RWV) bioreactors that simulate aspects of microgravity for cell cultures to analyze three models of antigen-specific activation. A mixed-lymphocyte reaction (MLR), as a model for a primary immune response; a tetanus toxoid (TT) response and a B. burgdorferi (Bb) response, as models of a secondary immune response,

were all suppressed in the RWV bioreactor. Our findings confirm that the suppression of activation observed with polyclonal models also encompasses oligoclonal antigen-specific activation.

Author

Antigens; Gravitational Physiology; Immunology; Microgravity; Space Flight; Bioastronautics; Aerospace Medicine; Physiological Effects

~~20000093331~~ Naval Health Research Center, Toxicology Detachment, Wright-Patterson AFB, OH USA

A Neurodevelopmental Study of the Effects of Oral Ammonium Perchlorate Exposure on the Motor Activity of Pre-Weanling Rat Pups, Feb.-Jun. 2000

Bekkedall, Marni Y., Naval Health Research Center, USA; Carpenter, Tonya, Naval Health Research Center, USA; Smith, Julie, Naval Health Research Center, USA; Ademujohn, Cynthia, Naval Health Research Center, USA; Maken, Debra, Naval Health Research Center, USA; Jun. 26, 2000; 55p; In English

Report No.(s): AD-A379703; TOXDET-00-03; No Copyright; Avail: CASI; A01, Microfiche; A04, Hardcopy

The objective was to assess the neurotoxicity of ammonium perchlorate as it relates to the development of the motor system. Ammonium perchlorate is used in solid rocket propellant systems, and has been found in ground water at sites where this propellant is manufactured and stored. It readily dissociates in water and produces perchlorate ion that displaces the iodide (I(-)) anion and disrupts thyroid activity. The thyroid becomes underactive (hypothyroidism), leading to reduced levels of thyroid hormones triiodothyronine (T3) and thyroxine (T4). There is some evidence to suggest thyroid hormones play an important role in normal brain development, including areas of the brain related to motor activity. Thus, a neurobehavioral test for spontaneous locomotor activity was employed to detect developmental abnormalities within the brain systems related to gross motor movement. Female rats were treated for two weeks prior to gestation through post-natal day (PND) 10 with one of 5 doses of ammonium perchlorate in their drinking water (0, 0.1, 1.0, 3.0, or 10.0 mg/kg/day). One male and female rat pup were randomly selected from each litter for testing of general locomotor activity at three preweanling ages - PNDs 14, 18, and 22. Pups were individually tested in automated Opto-Varimex Activity boxes where 9 different measures of activity were recorded for 90 consecutive minutes on each test day. Data was divided into 9, 10-minute blocks, and was analyzed separately for each of the 9 dependent variables using a repeated measures ANOVA. The main effect for drug dose was not significant for any of the 9 measures, and there were no reliable interactions for treatment. Statistically reliable results were found for expected effects, such as changes in overall activity at different ages, and reduced activity from the start of a given test session to the end of the session.

DTIC

Contamination; Ammonium Perchlorates; Solid Rocket Propellants; Rocket Oxidizers; Drinking; Water Pollution; Exposure; Toxicity; Ground Water

~~20000094309~~ NASA Johnson Space Center, Houston, TX USA

Initial Biological Damage from Space Radiation: Implications for Development of Biological Countermeasures

Cucinotta, Francis A., NASA Johnson Space Center, USA; [1999]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Astronauts are exposed to high-energy nuclear particles originating from the galactic cosmic rays, high-energy protons trapped in the Earth's magnetic field or solar particle events, and secondary radiation produced by nuclear reactions. Important differences between conventional radiation including X-rays or gamma-rays, and high-energy nuclei occur at the level of initial damage to DNA and other potential biological target molecules, and to tissues. Such differences include a large fraction of the initial damage from high charge and energy (HZE) nuclear particles manifested as irreparable lesions including small- and large-scale DNA deletions. Also, low dose-rate exposures in space result in a heterogeneous population of damaged cells distinct from energetic photon irradiation of tissue. We present an overview of the initial biological damage and dose and dose-rate effects produced by ionizing radiation using track structure and nuclear reaction models. Implications of the differences in cellular and tissue damage between conventional radiation and space radiation for the development of biological countermeasures are discussed.

Author

Deoxyribonucleic Acid; Extraterrestrial Radiation; Radiation Damage; Radiation Injuries; Aerospace Environments; Aerospace Safety; Bioastronautics

52 AEROSPACE MEDICINE

Includes the biological and physiological effects of atmospheric and space flight (weightlessness, space radiation, acceleration, and altitude stress) on the human being; and the prevention of adverse effects on those environments. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science. For the effects of space on animals and plants see 51 Life Sciences.

20000080475 Institute of Space Medico-Engineering, Beijing, China

Space Medicine and Medical Engineering

Wei, J.; Hangtian Yixue yu Yixue Gongcheng; Apr. 2000; Volume 13, No. 2; 88p; In Chinese; Portions of this document are not fully legible

Report No.(s): PB2000-106832; No Copyright; Avail: National Technical Information Service (NTIS)

Contents include the following: Original Research; Left Prefrontal Cortex Activation during Semantic Encoding Accessed with Functional Near Infrared Imaging (in English); Hemodynamic Assessment of Ischemic Stroke with Near-Infrared Spectroscopy (in English); Thermal Physiological Consideration of Precooling Procedures in Manned Space Craft (in English); EEG Synchronization Index Spectrum; Definition, Calculation and The Changes Related to Visual Selective Response; Mechanism of Pineal and Suprachiasmatic Regulation on Circadian Rhythm of Body Temperature in Rats; Cardiovascular Reactions to Gravitational Force in Different Directions; A Study on the Detection Method of Spontaneous Otoacoustic Emission Signals; Effects of Space Conditions on Mutation and Inheritance of Tomato; Analysis of Wavelet Scalogram of Blood Flow Ultrasonic Doppler Signal; Complexity Analysis of Surface EMG Signals; A Simulation Study of Cabin Pressure Changes under Accidental Leakage; e-fos Expression in Rat's Vestibular Nucleus Under Eccentric Rotational Stimulation; Measurements of Proton Response of Two Lithium Fluoride Detectors with Different Thicknesses; Brief Report; and Literature Review.

NTIS

Aerospace Medicine; Manned Space Flight; Physiological Effects; Biological Effects

20000081744 NASA Johnson Space Center, Houston, TX USA

Altered Cytokine Production by Specific Human Peripheral Blood Cell Subsets Immediately Following Spaceflight

Crucian, Brian E., Wyle Labs., Inc., USA; Cabbage, Michael L., Baylor Coll. of Medicine, USA; Sams, Clarence F., NASA Johnson Space Center, USA; [1999]; 18p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In this study, we have attempted to combine standard immunological assays with the cellular resolving power of the flow cytometer to positively identify the specific cell types involved in spaceflight-induced immune alterations. We have obtained whole blood samples from 27 astronauts collected at three timepoints (L-10, R+0 and R+3) surrounding four recent space shuttle missions. The duration of these missions ranged from 10 to 18 days. Assays performed included serum/urine cortisol, comprehensive subset phenotyping, assessment of cellular activation markers and intracellular cytokine production following mitogenic stimulation. Absolute levels of peripheral granulocytes were significantly elevated following spaceflight, but the levels of circulating lymphocytes and monocytes were unchanged. Lymphocyte subset analysis demonstrated trends towards a decreased percentage of T cells and an increased percentage of B cells. Nearly all of the astronauts exhibited an increased CD4:CD8 ratio, which was dramatic in some individuals. Assessment of memory (CD45RA+) vs. naive (CD45RO+) CD4+ T cell subsets was more ambiguous, with subjects tending to group more as a flight crew. All subjects from one mission demonstrated an increased CD45RA:CD45RO ratio, while all subjects from another Mission demonstrated a decreased ratio. While no significant trend was seen in the monocyte population as defined by scatter, a decreased percentage of the CD14+ CD16+ monocyte subset was seen following spaceflight in all subjects tested. In general, most of the cellular changes described above which were assessed at R+0 and compared to L-10 trended to pre-flight levels by R+3. Although no significant differences were seen in the expression of the cellular activation markers CD69 and CD25 following exposure to microgravity, significant alterations were seen in cytokine production in response to mitogenic activation for specific subsets. T cell (CD3+) production of IL-2 was significantly decreased after at R+0 as was IL-2 production by both CD4+ and CD8+ T cell subsets for most subjects. Production of IFN(sub gamma) did not appear to be affected by microgravity exposure in either T cells in general or in the CD8+ T cell subset. There was a spaceflight-induced decrease in IFN(sub gamma) production in the CD4+ T cell subset, however it did not reach statistical significance. Serum and urine stress-hormone analysis indicated significant physiologic stresses in astronauts following spaceflight. In summary, these results demonstrate alterations in the peripheral immune system of astronauts immediately after spaceflight of 10 to 18 days duration and support continued research regarding microgravity and immunology (including in-flight sampling) prior to routine long-term spaceflight for astronauts.

Author

Immunology; Assaying; Immunoassay; Sampling; Space Flight

20000081767 NASA Johnson Space Center, Houston, TX USA

Thyroid Function Changes Related to Use of Iodinated Water in USA Space Program

McMonigal, Kathleen A., NASA Johnson Space Center, USA; Braverman, Lewis E., Brigham and Women's Hospital, USA; Dunn, John T., Virginia Univ., USA; Stanbury, John B., Massachusetts Inst. of Tech., USA; Wear, Mary L., NASA Johnson Space Center, USA; Hamm, Peggy B., NASA Johnson Space Center, USA; Sauer, Richard L., NASA Johnson Space Center, USA; Billica, Roger D., NASA Johnson Space Center, USA; Pool, Sam L., NASA Johnson Space Center, USA; [1999]; 35p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The National Aeronautics and Space Administration (NASA) has used iodination as a method of microbial disinfection of potable water systems in USA spacecraft and long-duration habitability modules. A review of the effects on the thyroid following consumption of iodinated water by NASA astronauts was conducted. Pharmacological doses of iodine consumed by astronauts transiently decreased thyroid function, as reflected in serum TSH values. Although the adverse effects of excess iodine consumption in susceptible individuals are well documented, exposure to high doses of iodine during space flight did not result in a statistically significant increase in long-term thyroid disease in the astronaut population.

Derived from text

Thyroid Gland; Pharmacology; Iodine; Microorganisms; Potable Water

20000083353 NASA Johnson Space Center, Houston, TX USA

Unimpaired Neuro-Adaptive Plasticity in an Elderly Astronaut

Paloski, William H., NASA Johnson Space Center, USA; Black, F. Owen, Legacy Good Samaritan Hospital, USA; Metter, E. Jeffrey, Laboratory of Clinical Investigation, USA; [1999]; 2p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Quantitative analyses of a 77 year old astronaut's balance control performances on a standardized test battery revealed few differences between his neuro-adaptive responses to space flight and those of a group of younger astronauts tested following missions of similar duration. This finding suggests that the physiological changes associated with age do not necessarily impair adaptive plasticity in the human following removal and subsequent reintroduction of gravity.

Author

Neurophysiology; Age Factor; Aging (Biology); Gerontology; Astronauts; Physiological Responses; Gravitational Physiology; Gravitational Effects; Space Flight Stress

20000083882 NASA Johnson Space Center, Houston, TX USA

On The Development of Biophysical Models for Space Radiation Risk Assessment

Cucinotta, F. A., NASA Johnson Space Center, USA; Dicello, J. F., Johns Hopkins Univ., USA; [1999]; 10p; In English Contract(s)/Grant(s): RTOP 111-50-50-01; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Experimental techniques in molecular biology are being applied to study biological risks from space radiation. The use of molecular assays presents a challenge to biophysical models which in the past have relied on descriptions of energy deposition and phenomenological treatments of repair. We describe a biochemical kinetics model of cell cycle control and DNA damage response proteins in order to model cellular responses to radiation exposures. Using models of cyclin-cdk, pRB, E2F's, p53, and GI inhibitors we show that simulations of cell cycle populations and GI arrest can be described by our biochemical approach. We consider radiation damaged DNA as a substrate for signal transduction processes and consider a dose and dose-rate reduction effectiveness factor (DDREF) for protein expression.

Author

Biophysics; Models; Biochemistry; Cells (Biology); Damage; Deposition; Dosage; Energy Transfer; Extraterrestrial Radiation; Radiation Dosage; Risk

20000083905 Institute of Space Medico-Engineering, Beijing, China

Cardiovascular Reactions to Gravitational Force in Different Directions

Xue, Yue-Ying, Institute of Space Medico-Engineering, China; Liu, Guang-Yuan, Institute of Space Medico-Engineering, China; Xie, Bao-Sheng, Institute of Space Medico-Engineering, China; Cheng, Xue-Yao, Institute of Space Medico-Engineering, China; Wang, Yan-Chang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 104-108; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To observe the features of the cardiovascular reactions to gravitational forces along different axes of the body. Dogs were exposed to gravitational forces along axes of body on an animal centrifuge. It was found that when the direction of G force changed from +G_z to +G_x, the predominating effect on the cardiovascular system changed from the drop of eye level blood pressure to the increase of central venous pressure, and the reactions of the organism changed from a presson reflex of the arterial system to the inhibition of cardiac activities at higher G levels. The turning point was found to be at the back angle of 75 degrees with respect

to the direction of the gravitational force. These findings provide an important reference for choosing the optimal seat back angle in a manned space vehicle.

Author

Acceleration (Physics); Cardiovascular System; Gravitational Fields; Aerospace Medicine; Directivity; Dogs

20000083953 Institute of Space Medico-Engineering, Beijing, China

Relation to GFR and Endothelin in the Plasma in Pilots and Ground Crew

Dai, Yu, Institute of Space Medico-Engineering, China; Dai, Da-Jiang, Institute of Space Medico-Engineering, China; Ji, Guiying, Institute of Space Medico-Engineering, China; Ren, Qu, Institute of Space Medico-Engineering, China; Wang, Xue-Juan, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 143-145; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To observe the specific property of Glomerular Filtration Rate (GFR) and its relation to endothelin of plasma in pilots. GFR was assessed with single photon emission computed tomography (SPECT), tracer for ^{99m}Tc -DTPA, endothelin of plasma were measured by radio immunoassay in forty-six pilots, thirty ground crew and renal disease patients. Endothelin were not correlation with GFR in pilots. GFR of pilots and ground crew had not a significant difference. Compared with ground crew and pilots, endothelin of renal disease patients had a significant increased, and GFR had a significant decreased. Age were a linear negative correlation with total GFR $r = (0.84, P \text{ less than } 0.01)$, flying time, age had not correlation with endothelin. After thirty-one ground endothelin had a significant difference with ground crew. It suggested that the endothelin has no influence on GFR in pilots when it was increased with in the limits of a level, pilots and ground crew may use the same stand on GFR.

Author

Filtration; Plasmas (Physics); Glomerulus; Endothelium; Aircraft Pilots; Ground Crews; Aerospace Medicine

20000084131 Institute of Space Medico-Engineering, Beijing, China

Analyse of Frequency Band in Acceleration Measurements During Ejection and Parachuting

Wu, Ming-Lei, Institute of Space Medico-Engineering, China; Li, Bao-Hui, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 140-142; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To describe and determine the frequency band in the acceleration measurements during ejection and parachuting. Comprehensive review of literatures and analysis of the data procedure in the MIL-S-18471G(AS). The human body has a low frequency response which is less than 50Hz. The frequency band of acceleration of ejection and parachuting is within 200Hz. The moving average procedure of 11 data in the MIL-S-18471G(AS) allow the frequency components below 40Hz to pass, but attenuated the frequency components between 40 and 74Hz, and suppressed the frequency components over 74Hz. When the measurements are used for the analysis of human body response, the frequency low pass filter may be 0-80 Hz or 0-200 Hz with the moving average procedure of 11 data.

Author

Ejection; Frequency Response; Parachute Descent; Acceleration Measurement; Aerospace Medicine

20000084132 Institute of Space Medico-Engineering, Beijing, China

The Progress in Research on the Mechanisms of the Effects of Blood Volume Reduction on Orthostatic Tolerance After Microgravity of Simulated Microgravity

Wang, De-Sheng, Institute of Space Medico-Engineering, China; Ren, Wei, Institute of Space Medico-Engineering, China; Xiang, Qiu-Lu, Institute of Space Medico-Engineering, China; Sun, Lei, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 152-156; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

Orthostatic intolerance commonly occurs after spaceflight, but its mechanisms remain to be clarified. It is believed that the reduction of blood volume might be one of the important factors. So the current countermeasures against orthostatic intolerance are aimed to control the changes of blood volume. The main differences between physiological effects of microgravity and simulated microgravity on humans appear in the circulation of the low pressure side and in humoral and electrolyte metabolism. Reflexes elicited from the low pressure side are very important for regulation of the extracellular fluids. The authors postulated that for a further understanding of mechanisms of orthostatic intolerance after spaceflight and to establish appropriate countermeasures against orthostatic intolerance, It is important to study the course of changes of the circulation in the low pressure side and the reflexes thus elicited with more appropriate method of simulation.

Author

Blood Volume; Microgravity; Orthostatic Tolerance; Aerospace Medicine; Computerized Simulation; Physiological Effects

20000084164 NASA Johnson Space Center, Houston, TX USA

Modeling Calcium Loss from Bones During Space Flight

Wastney, Meryl E., Georgetown Univ. Medical Center, USA; Morukov, Boris V., Institute of Biomedical Problems, USSR; Larina, Irina M., Institute of Biomedical Problems, USSR; Abrams, Steven A., Baylor Coll. of Medicine, USA; Nillen, Jeannie L., Enterprise Advisory Services, Inc., USA; Davis-Street, Janis E., Enterprise Advisory Services, Inc., USA; Lane, Helen W., NASA Johnson Space Center, USA; Smith, Scott M., NASA Johnson Space Center, USA; [1999]; 5p; In English; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Calcium loss from bones during space flight creates a risk for astronauts who travel into space, and may prohibit space flights to other planets. The problem of calcium loss during space flight has been studied using animal models, bed rest (as a ground-based model), and humans in-flight. In-flight studies have typically documented bone loss by comparing bone mass before and after flight. To identify changes in metabolism leading to bone loss, we have performed kinetic studies using stable isotopes of calcium. Oral (Ca-43) and intravenous (Ca-46) tracers were administered to subjects (n=3), three-times before flight, once in-flight (after 110 days), and three times post-flight (on landing day, and 9 days and 3 months after flight). Samples of blood, saliva, urine, and feces were collected for up to 5 days after isotope administration, and were analyzed for tracer enrichment. Tracer data in tissues were analyzed using a compartmental model for calcium metabolism and the WinSAAM software. The model was used to: account for carryover of tracer between studies, fit data for all studies using the minimal number of changes between studies, and calculate calcium absorption, excretion, bone calcium deposition and bone calcium resorption. Results showed that fractional absorption decreased by 50% during flight and that bone resorption and urinary excretion increased by 50%. Results were supported by changes in biochemical markers of bone metabolism. Inflight bone loss of approximately 250 mg Ca/d resulted from decreased calcium absorption combined with increased bone resorption and excretion. Further studies will assess the time course of these changes during flight, and the effectiveness of countermeasures to mitigate flight-induced bone loss. The overall goal is to enable human travel beyond low-Earth orbit, and to allow for better understanding and treatment of bone diseases on Earth.

Author

Calcium Metabolism; Losses; Astronauts; Bed Rest; Bone Demineralization; Space Flight

20000084330 NASA Johnson Space Center, Houston, TX USA

Evaluation and Treatment of Essential Hypertension During Short Duration Space Flight

Rossum, Alfred C., Kelsey Seybold, USA; Baisden, Dennis L., NASA Johnson Space Center, USA; [2000]; 2p; In English, 14-28 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA
Report No.(s): ASMA-A-001741-ASMA; No Copyright; Avail: Issuing Activity; Abstract Only

During the last four decades of manned space flight, two individuals have successfully flown in space with the preflight diagnosis of essential hypertension (HTN). Treatment of this disease process in the astronaut population warrants special consideration particularly when selecting medication for a mission. A retrospective review of data offers two different clinical scenarios involving the treatment, or lack thereof, for essential hypertension during space flight. Case I: A Caucasian quinquagenarian diagnosed with HTN one year prior to the mission obtained flight certification after a negative diagnostic workup. The patient was placed on a diuretic. Preflight isolated blood pressure (BP) measurements averaged 138/102. Inflight, the patient electively declined medication. A 36-hour BP monitor revealed an average value of 124/87. Postflight, BP measurements returned to preflight BP values. Case II: A Caucasian quaterogenarian diagnosed with HTN 6 months prior to launch completed flight training after a negative diagnostic workup. The patient was placed on an ACE inhibitor. Preflight BP measurements averaged 130/80. Inflight, isolated BP measurements were considerably less. Normotensive values were obtained postflight. In both cases, BP values inflight were lower than pre or postflight values. Yelle et al has confirmed similar findings in the normotensive astronaut population. Spaceflight may result in fluid shifting, mild dehydration, electrolyte imbalance, orthostatic hypotension, and increased heart rates. Based on these factors, certain classes of antihypertensive agents such as vasodilators, beta-blockers, and diuretics are excluded from consideration as a primary therapeutic modality. To date, ACE Inhibitors are viewed as the more acceptable drug of choice during spaceflight. Newer classes of drugs may also provide additional choices. Presently, astronauts developing uncomplicated HTN may continue their careers when treated with the appropriate class of continue their careers when treated with the appropriate class of antihypertensive medication.

Author

Evaluation; Medical Services; Hypertension; Astronauts; Manned Space Flight

20000084334 NASA Johnson Space Center, Houston, TX USA

Pulmonary Toxicity Study of Lunar and Martian Dust Simulants Intratracheally Instilled in Mice

Lam, Chiu-Wing, Wyle Labs., Inc., USA; James, John T., NASA Johnson Space Center, USA; Latch, John A., Texas Univ., USA; Holian, A., Texas Univ., USA; McCluskey, R., University of South Florida, USA; [2000]; 1p; In English, 19-23 Mar. 2000,

Philadelphia, PA, USA; Sponsored by Society of Toxicology, USA; No Copyright; Avail: Issuing Activity; Abstract Only

NASA is contemplating sending humans to Mars and the Moon for further exploration. The properties of Hawaiian and Californian volcanic ashes allow them to be used to simulate Martian and lunar dusts, respectively. NASA laboratories use these dust simulants to test performance of hardware destined for Martian or lunar environments. Workers in these test facilities are exposed to low levels of these dusts. The present study was conducted to investigate the toxicity of these dust simulants. Particles of respirable-size ranges of lunar simulant (LS), Martian simulant (MS), TiO₂ (negative control) and quartz (positive control) were each intratracheally instilled (saline as vehicle) to groups of 4 mice (C57BL, male, 2-3 month old) at a single treatment of 1 (Hi dose) or 0.1 (Lo dose) mg/mouse. The lungs were harvested at the end of 7 days or 90 days for histopathological examination. Lungs of the LS-Lo groups had no evidence of inflammation, edema or fibrosis. The LS-Hi-7d group had mild to moderate acute inflammation, and neutrophilic and lymphocytic infiltration; the LS-Hi-90d group showed signs of chronic inflammation and some fibrosis. Lungs of the MS-Lo-7d group revealed mild inflammation and neutrophilic and lymphocytic infiltration; the MS-Lo-90d group showed mild fibrosis and particle-laden macrophages (PLM). Lungs of the MS-Hi-7d group demonstrated mild to moderate inflammation and large foci of PLM; the MS-Hi-90d group showed chronic mild to moderate inflammation and fibrosis. To mimic the effects of the oxidative and reactive properties of Martian soil surface, groups of mice were exposed to ozone (3 hour at 0.5 ppm) prior to MS dust instillation. Lung lesions in the MS group were more severe with the pretreatment. The results for the negative and positive controls were consistent with the known pulmonary toxicity of these compounds. The overall severity of toxic insults to the lungs were TiO₂<LS<MS<Quartz. For the mice in the 90-d study, blood samples were taken for immunotoxicity study. Antinuclear antibodies (such as those against Golgi, kinetichore, and centromere) were detected in serum in a greater extent in mice treated with LS than those with quartz, suggesting that LS, like quartz, has the potential of inducing autoimmune disease.

Author

Toxicity; Lunar Dust; Mars (Planet); Mars Environment; Lunar Environment; Moon

20000085854 NASA Johnson Space Center, Houston, TX USA

Epstein-Barr Virus Reactivation Associated with Diminished Cell-Mediated Immunity in Antarctic Expeditioners

Pierson, Duane L., NASA Johnson Space Center, USA; Mehta, Satish K., Enterprise Advisory Services, Inc., USA; Cooley, Helen, Enterprise Advisory Services, Inc., Australia; Dubow, Robin, Enterprise Advisory Services, Inc., Australia; Lugg, Desmond, Enterprise Advisory Services, Inc., Australia; [1999]; 20p; In English

Contract(s)/Grant(s): RTOP 111-30-10-03; RTOP 111-30-10-06; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Reactivation of Epstein-Barr virus (EBV) and cell-mediated immune (CMI) responses were followed in 16 Antarctic expeditioners during winter-over isolation at two Australian National Antarctic Research Expedition stations. Delayed-type hypersensitivity skin testing was used as an indicator of the CMI response, which was evaluated two times before winter isolation and three times during isolation. At all five evaluation times, 8 or more of the 16 subjects had a diminished CMI response. Diminished CMI was observed on every test occasion in 4/16 subjects; only 2/16 subjects exhibited normal CMI responses for all five tests. A polymerase chain reaction (PCR) assay was used to detect EBV DNA in saliva specimens collected before, after, and during the winter isolation. EBV DNA was present in 17% (111/642) of the saliva specimens; all 16 subjects shed EBV in their saliva on at least one occasion. The probability of EBV shedding increased ($p=0.013$) from 6% before or after winter isolation to 13% during the winter period. EBV appeared in saliva during the winter isolation more frequently ($p<0.0005$) when CMI responsiveness was diminished than when CMI status was normal. The findings indicate that the psychosocial, physical, and other stresses associated with working and living in physical isolation during the Antarctic winter results in diminished CMI and an accompanying increased reactivation and shedding of latent viruses.

Author

Viruses; Deoxyribonucleic Acid; Expeditions; Physiological Responses; Assaying

20000085869 NASA Johnson Space Center, Houston, TX USA

Orthostatic Intolerance and Motion Sickness After Parabolic Flight

Schlegel, Todd T., NASA Johnson Space Center, USA; Brown, Troy E., Wyle Labs., Inc., USA; Wood, Scott J., Baylor Coll. of Medicine, USA; Benavides, Edgar W., Wyle Labs., Inc., USA; Bondar, Roberta L., Ryerson Polytechnic Univ., Canada; Stein, Flo, Maple Lake Non-Invasive Vascular Lab., USA; Moradshahi, Peyman, Ryerson Polytechnic Univ., Canada; Harm, Deborah L., NASA Johnson Space Center, USA; Low, Phillip A., Mayo Foundation, USA; [1999]; 45p; In English

Contract(s)/Grant(s): RTOP 199-16-11-56; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Orthostatic intolerance is common in astronauts after prolonged space flight. However, the "push-pull effect" in military aviators suggests that brief exposures to transitions between hypo- and hypergravity are sufficient to induce untoward autonomic cardiovascular physiology in susceptible individuals. We therefore investigated orthostatic tolerance and autonomic

cardiovascular function in 16 healthy test subjects before and after a seated 2-hr parabolic flight. At the same time, we also investigated relationships between parabolic flight-induced vomiting and changes in orthostatic and autonomic cardiovascular function. After parabolic flight, 8 of 16 subjects could not tolerate a 30-min upright tilt test, compared to 2 of 16 before flight. Whereas new intolerance in non-Vomiters resembled the clinical postural tachycardia syndrome (POTS), new intolerance in Vomiters was characterized by comparatively isolated upright hypocapnia and cerebral vasoconstriction. As a group, Vomiters also had evidence for increased postflight fluctuations in efferent vagal-cardiac nerve traffic occurring independently of any superimposed change in respiration. Results suggest that syndromes of orthostatic intolerance resembling those occurring after space flight can occur after a brief (i.e., 2-hr) parabolic flight.

Author

Motion Sickness; Vomiting; Long Duration Space Flight; Orthostatic Tolerance; Parabolic Flight; Autonomic Nervous System; Cardiovascular System; High Gravity Environments

20000085872 NASA Johnson Space Center, Houston, TX USA

Detailed Comparison of Observed Dose-Time Profile of October 19-20, 1989 SPE on Mir with Model Calculations

Badhwar, Gautam D., NASA Johnson Space Center, USA; Atwell, William, Boeing North American, Inc., USA; [1999]; 1p; In English

Contract(s)/Grant(s): RTOP 111-50-50-01; No Copyright; Avail: Issuing Activity; Abstract Only

The dose rate dynamics of the October 19-20, 1989 solar energetic particle (SPE) event as observed by the Liulin instrument onboard the Mir orbital station was analyzed in light of new calculations of the geomagnetic cutoff and improved estimates of the less than 100 MeV energy spectra from the GOES satellite instrument. The new calculations were performed using the as-flown Mir orbital trajectory and includes time variations of the cutoff rigidity due to changes in the kappa (sub p) index. Although the agreement of total event integrated calculated dose to the measured dose is good, it results from some measured dose-time profile been higher and some lower than model calculations. They point to the need to include the diurnal variation of the geomagnetic cutoff and modifications of the cutoffs to variations in kappa (sub p) in model calculations. Understanding of such events in light of the upcoming construction of the International Space Station during the period of maximum solar activity needs to be vigorously pursued.

Author

Solar Activity; Energy Spectra; Energetic Particles; Dosage; Time Functions

20000085877 NASA Johnson Space Center, Houston, TX USA

The Russian-U.S. Experience with Development Joint Medical Support Procedures for Before and After Long-Duration Space Flights

Morgun, V. V., Yu.A. Gagarin Cosmonaut Training Center, Russia; Voronin, L. I., Yu.A. Gagarin Cosmonaut Training Center, Russia; Kaspransky, R. R., Yu.A. Gagarin Cosmonaut Training Center, Russia; Pool, S. L., NASA Johnson Space Center, USA; Barratt, M. R., NASA Johnson Space Center, USA; Novinkov, O. L., Wyle Labs., Inc., USA; [1999]; 19p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As the Russian Space Agency (RSA) and the U.S. National Aviation and Space Administration (NASA) began in the mid 1990s to plan a preliminary cooperative flight program in anticipation of the International Space Station, programmatic and philosophical differences became apparent in the technical and medical approaches of the two agencies. This paper briefly describes some of these differences and the process by which the two sides resolved differences in their approaches to the medical selection and certification of Shuttle-Mir crew members. These negotiations formed the basis for developing policies on other aspects of the medical support function for international missions, including crew training, preflight and postflight data collection, and rehabilitation protocols. The experience gained through this cooperative effort has been invaluable for developing medical care capabilities for the International Space Station.

Author

Medical Services; Intravenous Procedures; In Vivo Methods and Tests; Spacecrews; Long Duration Space Flight; Astronaut Training

20000085924 NASA Johnson Space Center, Houston, TX USA

Relative Efficiency of TLD-100 to High Linear Energy Transfer Radiation: Correction to Astronaut Absorbed Dose

Badhwar, G. D., NASA Johnson Space Center, USA; Cash, B. L., Lockheed Martin Corp., USA; Semones, E. J., Lockheed Martin Corp., USA; Yasuda, H., National Inst. for Radiological Sciences, Japan; Fujitaka, K., National Inst. for Radiological Sciences, Japan; 1999; 12p; In English

Contract(s)/Grant(s): RTOP 111-50-20; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Response of thermoluminescent detectors (TLD-100) to high linear energy transfer (LET) particles has been studied using helium, carbon, silicon, and iron ions from the Heavy Ion Medical Accelerator at Chiba (Japan), iron ions from the Brookhaven National Laboratory (NY) Alternate Gradient Synchrotron, and 53, 134, 185, and 232 MeV protons from the Loma Linda accelerator. Using the measured relative (to ^{137}Cs) dose efficiency, and measured LET spectra from a tissue equivalent proportional counter (TEPC) on 20 Space Shuttle flights, and 7 Mir flights, the underestimation of absorbed dose by these detectors has been evaluated. The dose underestimation is between 15-20% depending upon the flight inclination and shielding location. This has been confirmed by direct correlation of measured dose by TEPC and TLD-100 at a low shielded location in the Shuttle mid-deck. A comparison of efficiency- LET data with a compilation of similar data from TLD-700, shows that shapes of the two curves are nearly identical, but that the TLD-100 curve is systematically lower by about 13%, and is the major cause of dose underestimation. These results strongly suggest that TLDs used for crew dose estimation be regularly calibrated using heavy ions.

Author

Aerospace Medicine; Linear Energy Transfer (LET); Radiation Dosage; Thermoluminescence

20000085930 NASA Johnson Space Center, Houston, TX USA

Effect of Spaceflight on the Functions of NK and LAK Cells

Pierson, Duane L., Enterprise Advisory Services, Inc., USA; Grimm, Elizabeth A., Texas Univ., USA; Pierson, Duane L., NASA Johnson Space Center, USA; [1999]; 1p; In English; Society for Leukocyte Biology '99, 22-26 Sep. 1999, Cambridge, UK; No Copyright; Avail: Issuing Activity; Abstract Only

Spaceflight-associated stress alters some aspects of the human immune response. In this study, we determined the effects of 10 days aboard the Space Shuttle on the cytotoxic activity of NK and LAK cells. The subjects of this study were crewmembers of two 10-day shuttle flights. Ten-ml blood specimens were obtained from ten astronauts 10 days before launch, immediately after landing, and 3 days after landing. PBMCs were separated from the blood specimens and stored at -800 C. All PBMCs were thawed simultaneously, and the cytotoxic activities of NK and LAK cells were measured by a 4-hour Cr-51 release assay. K562 cells were used to assess NK-cell cytotoxicity. After 4 days of IL-2 activation, the LAK cell cytotoxic activity was determined using K562 and Daudi cells as the target cells. NK-cell cytotoxicity was decreased at landing (p less than 0.0005) in 9/10 astronauts, and in most cases recovered to preflight levels by 3 days after landing; NK-cell cytotoxicity was increased in one astronaut at landing. LAK cytotoxic activity against K562 cells was decreased at landing in 6/10 astronauts ($p=0.018$), and activity against Daudi cells was decreased in 7/10 astronauts ($p=0.01$). Phenotyping of PBMCs and LAK cells showed alterations in some surface markers and adhesion molecules (CD1 1 b, CD1 1 c, CD1 1 a, CD1 6, L-Selectin and CD3). Thus spaceflight leads to a decrease in the functions of NK and LAK cells in most astronauts.

Author

Chromium Isotopes; Human Reactions; Molecules; Space Flight; Toxins and Antitoxins

20000085941 NASA Johnson Space Center, Houston, TX USA

Relative Efficiency of TLD-100 to Linear Energy Transfer Radiation: Correction to Astronaut Absorbed Dose

Badhwar, Gautam D., NASA Johnson Space Center, USA; Cash, B. L., Lockheed Martin Corp., USA; Semones, E. J., Lockheed Martin Corp., USA; Yasuda, H., National Inst. of Radiological Sciences, Japan; Fujitaka, K., National Inst. of Radiological Sciences, Japan; [1999]; 1p; In English

Contract(s)/Grant(s): RTOP 111-50-50; No Copyright; Avail: Issuing Activity; Abstract Only

Response of thermoluminescent detectors (TLD-100) to high linear energy transfer (LET) particles has been studied using helium, carbon, silicon, and iron ions from the Heavy Ion Medical Accelerator at Chiba (Japan), iron ions from the Brookhaven National Laboratory (NY) Alternate Gradient Synchrotron, and 53, 134, 185, and 232 MeV protons from the Loma Linda accelerator. Using the measured relative (to ^{137}Cs) dose efficiency, and measured LET spectra from a tissue equivalent proportional counter (TEPC) on 20 Space Shuttle flights, and 7 Mir flights, the underestimation of absorbed dose by these detectors has been evaluated. The dose underestimation is between 15-20% depending upon the flight inclination and shielding location. This has been confirmed by direct correlation of measured dose by TEPC and TLD-100 at a low shielded location in the Shuttle mid-deck. A comparison of efficiency- LET data with a compilation of similar data from TLD-700, shows that shapes of the two curves are nearly identical, but that the TLD-100 curve is systematically lower by about 13%, and is the major cause of dose underestimation. These results strongly suggest that TLDs used for crew dose estimation be regularly calibrated using heavy ions.

Author

Thermoluminescence; Analyzers; Linear Energy Transfer (LET); Proportional Counters; Radiation Dosage; Shielding

20000085958 NASA Johnson Space Center, Houston, TX USA

Space Medicine: A Surgeon's Perspective

Dawson, David L., NASA Johnson Space Center, USA; [1999]; 1p; In English; Cardiovascular Surgeon's Society, 22-23 Oct. 1999, Des Moines, IA, USA; Sponsored by Iowa Heart Inst., USA; No Copyright; Avail: Issuing Activity; Abstract Only

For the first four decades of human space flight NASA's priorities in life sciences and medical programs have been preventative medicine (astronaut selection and training); assessment of the physiologic effects of microgravity and other unique aspects of space flight, implementation of countermeasures to protect against adverse effects, and amelioration of these adverse effects. Because most of the U.S. space flight experience has been on short duration missions, the need for medical and diagnostic treatment capabilities have been limited. The first long-term crews will arrive on the International Space Station (ISS) in early 2000. This will usher in a new era, an era of sustained human presence in Low Earth Orbit. One of the principal purposes of the ISS program is to increase the knowledge of the effects of long duration space flight on humans, a pre-requisite to future exploration class missions beyond Low Earth Orbit (e.g., a return to the Moon or an exploration of Mars). Areas of particular interest include protection from radiation, muscle atrophy, bone loss, cardiovascular alterations, immune dysfunction, adverse psychological response to hazards and confinement, and neurovestibular alterations. In addition, long duration space flight requires the development of autonomous medical care capabilities, as the distances involved eliminate the possibility of real-time telemedicine or robotic intervention, and prevent a mission abort and a rapid return to Earth. The objectives of this presentation include: 1. A description of the International Space Station project, including its research facilities and on-orbit medical capabilities; 2. An overview of the physiological and medical problems associated with microgravity in space flight; 3. A review of NASA's biomedical research priorities and ongoing work to develop clinical care capabilities for space flight crews (including surgical interventions) and; 4. An overview of current and proposed research priorities for NASA Research Announcements, NASA Space Biomedical Research Institute, Small Business Innovation Research Grant, and other funding sources.

Author

Aerospace Medicine; Surgeons; Manned Space Flight; International Space Station; Physiological Responses

20000085959 Wyle Labs., Inc., Houston, TX USA

The Role of Psychology and Behavioral Sciences for International Space Station Missions

Galarza, Laura, Wyle Labs., Inc., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Human performance on the International Space Station (ISS) involves a shift from the transient work of short-duration shuttle missions to the unique demands of long-duration missions (LDM). Long-duration ISS missions will involve challenges including group living with people from diverse cultural and vocational backgrounds, isolation, extended separation from family, reduced privacy, and limited resources. These demands will result in a greater emphasis on effective interpersonal communication, multicultural adaptability, group living skills, and self-management among other astronaut proficiencies. The psychological selection, training and mission support processes for LDM crewmembers at NASA were revised to address the unique demands of ISS missions. This symposium will describe in general terms the major issues involved in and the types of tools used for the psychological selection, training, and operational psychology and behavioral health support of NASA astronauts assigned to ISS missions. Furthermore, we will describe research on group dynamics conducted in space-analogous environments and their relevance to the ISS. The overall importance of behavioral science to space exploration will be discussed.

Author

International Space Station; Psychology; Human Behavior; Space Missions; Aerospace Medicine; Long Duration Space Flight

20000085960 NASA Johnson Space Center, Houston, TX USA

Application of an Electronic Medical Record in Space Medicine

McGinnis, Patrick J., NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-28 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Electronic Medical Records (EMR) have been emerging over the past decade. Today, they are replacing the paper chart in clinics throughout the nation. Approximately three years ago, the NASA-JSC Flight Medicine Clinic initiated an assessment of the EMRs available on the market. This assessment included comparing these products with the particular scope of practice at JSC. In 1998, the Logician EMR from Medicalogic was selected for the JSC Flight Medicine Clinic. This presentation reviews the process of selection and implementation of the EMR into the unique practice of aerospace medicine at JSC.

Author

Aerospace Medicine; Records Management; Electronic Equipment

20000085962 NASA Johnson Space Center, Houston, TX USA

Inflight Medical Events in the Shuttle Program

Baisden, Denise L., NASA Johnson Space Center, USA; Effenhauser, R. K., NASA Johnson Space Center, USA; Wear, Mary L., Wyle Labs., Inc., USA; [1999]; 2p; In English, 14-28 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Since the first launch of the Space Shuttle in 1981, the astronauts and their flight surgeons have dealt with a variety of inflight medical issues. A review will be provided of these issues as well as medications used in the treatment of these medical problems. Detailed medical debriefs are conducted by the flight surgeon with the individual crewmembers three days after landing. These debriefs were review for Shuttle flights from 1988 through 1999 to determine the frequency of inflight medical events. Medical events were grouped by ICD category and the frequency of medical events within those categories were reviewed. The ICD category of Symptoms, Signs and Ill-defined Conditions had the most medical events. Facial fullness and headache were the most common complaints within this category. The ICD category of Respiratory System had the next most common medical events with sinus congestion being the most common complaint. This was followed by Digestive System complaints and Nervous System/Sense Organ complaints. A variety of inflight medical events have occurred throughout the Shuttle program. Fortunately, the majority of these problems have been minor and have been well within the capability of the medical equipment flown and the skills of the Crew Medical Officers. Medical problems/procedures that are routine on the ground often present unique problems in the space flight environment. It is important that the flight surgeon understand the common medical problems encountered.

Author

Space Shuttles; Aerospace Medicine; Signs and Symptoms; Astronauts; Manned Space Flight

20000085963 Wyle Labs., Inc., Houston, TX USA

Behavioral Health Support of NASA Astronauts for International Space Station Missions

Sipes, Walter, Wyle Labs., Inc., USA; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Two areas of focus for optimizing behavioral health and human performance during International Space Station missions are 1) sleep and circadian assessment and 2) behavioral medicine. The Mir experience provided the opportunity to examine the use and potential effectiveness of tools and procedures to support the behavioral health of the crew. The experience of NASA has shown that on-orbit performance can be better maintained if behavioral health, sleep, and circadian issues are effectively monitored and properly addressed. For example, schedules can be tailored based upon fatigue level of crews and other behavioral and cognitive indicators to maximize performance. Previous research and experience with long duration missions has resulted in the development and upgrade of tools used to monitor fatigue, stress, cognitive function, and behavioral health. Self-assessment and objective tools such as the Spaceflight Cognitive Assessment Tool have been developed and refined to effectively address behavioral medicine countermeasures in space.

Author

Astronauts; Human Performance; International Space Station; Human Behavior; Aerospace Medicine; Human Factors Engineering; NASA Space Programs

20000085965 Texas Univ., Galveston, TX USA

Women's Health Issues in the Space Environment

Jennings, Richard T., Texas Univ., USA; [1999]; 2p; In English, 14-28 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Women have been an integral part of US space crews since Sally Ride's mission in 1983, and a total of 40 women have been selected as US astronauts. The first Russian female cosmonaut flew in 1963. This presentation examines the health care and reproductive aspects of flying women in space. In addition, the reproductive implications of delaying one's childbearing for an astronaut career and the impact of new technology such as assisted reproductive techniques are examined. The reproductive outcomes of the US female astronauts who have become pregnant following space flight exposure are also presented. Since women have gained considerable operational experience on the Shuttle, Mir and during EVA, the unique operational considerations for preflight certification, menstruation control and hygiene, contraception, and urination are discussed. Medical and surgical implications for women on long-duration missions to remote locations are still evolving, and enabling technologies for health care delivery are being developed. There has been considerable progress in the development of microgravity surgical techniques, including laparoscopy, thoracoscopy, and laparotomy. The concepts of prevention of illness, conversion of surgical conditions to medically treatable conditions and surgical intervention for women on long duration space flights are considered.

Author

Aerospace Environments; Females; Health; Reproduction (Biology); Astronauts; Aerospace Medicine

20000085972 NASA Langley Research Center, Hampton, VA USA

Aerospace Medicine and Biology: A Continuing Bibliography with Indexes, Supplement 503

August 2000; 35p; In English

Report No.(s): NASA/SP-2000-7011/SUPPL503; NAS 1.21:7011/SUPPL503; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This report lists reports, articles and other documents recently announced in the NASA STI Database.

Derived from text

Data Bases; Bibliographies; Aerospace Medicine; Biological Effects; Physiological Effects; Psychological Effects

20000085973 NASA Johnson Space Center, Houston, TX USA

In Situ Activation of Microcapsules

Morrison, Dennis R., Inventor, NASA Johnson Space Center, USA; Mosier, Benjamin, Inventor, NASA Johnson Space Center, USA; Aug. 08, 2000; 28p; In English; Continuation-in-part of US-Patent-Appl-SN-349169, filed 2 Dec. 1994

Patent Info.: Filed 15 May 1998; NASA-Case-MSC-22866-1; US-Patent-6,099,864; US-Patent-Appl-SN-079741; US-Patent-Appl-SN-349169; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Disclosed are microcapsules comprising a polymer shell enclosing two or more immiscible liquid phases in which a drug, or a prodrug and a drug activator are partitioned into separate phases. or prevented from diffusing out of the microcapsule by a liquid phase in which the drug is poorly soluble. Also disclosed are methods of using the microcapsules for in situ activation of drugs where upon exposure to an appropriate energy source the internal phases mix and the drug is activated in situ.

Author

Activation; Drugs; Capsules; Polymers; Pharmacology

20000085979 NASA Johnson Space Center, Houston, TX USA

Sensitivity of The Dynamic Visual Acuity Test to Sensorimotor Change

Cohen, Helen, Baylor Coll. of Medicine, USA; Bloomberg, Jacob, NASA Johnson Space Center, USA; Elizalde, Elizabeth, Baylor Coll. of Medicine, USA; Fregia, Melody, Baylor Coll. of Medicine, USA; [1999]; 1p; In English; Biomedical Engineering, 11-12 Feb. 1999, Houston, TX, USA; Sponsored in part by Clayton Foundation for Research

Contract(s)/Grant(s): NCC9-58; No Copyright; Avail: Issuing Activity; Abstract Only

Post-flight astronauts, acutely post-vestibular nerve section patients, and patients with severe chronic bilateral vestibular deficits have oscillopsia caused by reduced vestibulocular reflex gains and decreased postural stability. Therefore, as previous work has shown, a test of dynamic visual acuity (DVA), in which the subject must read numbers from a computer screen while standing still or walking in place provides a composite measure of sensorimotor integration. This measure may be useful for determining the level of recovery, post-flight, post-operatively, or after vestibular rehabilitation. to determine the sensitivity of DVA to change in impaired populations we have tested patients with acoustic neuromas before and during the first post-operative week after resection of the tumors, and with bilaterally labyrinthine deficient subjects before and after six weeks of balance rehabilitation therapy.

Derived from text

Aerospace Medicine; Dynamic Tests; Visual Acuity; Sensorimotor Performance; Sensitivity

20000086223 NASA Johnson Space Center, Houston, TX USA

Incidence of Epstein-Barr Virus in Astronaut Saliva During Spaceflight

Payne, Deborah A., Texas Univ., USA; Mehta, Satish K., Enterprise Advisory Services, Inc., USA; Tying, Stephen K., Texas Univ., USA; Stowe, Raymond P., Texas Univ., USA; Pierson, Duane L., NASA Johnson Space Center, USA; [1998]; 14p; In English

Contract(s)/Grant(s): RTOP 106-20-00; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Astronauts experience psychological and physical stresses that may result in re-activation of latent viruses during spaceflight, potentially increasing the risk of disease among crew members. The shedding of Epstein-Barr virus (EBV) in the saliva of astronauts will increase during spaceflight. A total of 534 saliva specimens were collected from 11 EBV-seropositive astronauts before, during, and after four space shuttle missions. The presence of EBV DNA in saliva, assessed by polymerase chain reaction (PCR), was used to determine shedding patterns before, during, and after spaceflight. EBV DNA was detected more frequently before flight than during (p less than 0.001) or after (p less than 0.01) flight. No significant difference between the in-flight and

postflight periods was detected in the frequency of occurrence of EBV DNA. The increased frequency of shedding of EBV before flight suggests that stress levels may be greater before launch than during or after spaceflight.

Author

Viruses; Space Flight; Saliva; Diseases; Deoxyribonucleic Acid; Astronauts

20000086666 NASA Johnson Space Center, Houston, TX USA

Spatial Orientation and Balance Control Changes Induced by Altered Gravito-Inertial Force Vectors in Vestibular Deficient Patients

Kaufman, Galen D., NASA Johnson Space Center, USA; Wood, Scott J., Baylor Coll. of Medicine, USA; Gianna, Claire C., Legacy Health System, USA; Black, F. Owen, Legacy Health System, USA; Paloski, William H., NASA Johnson Space Center, USA; [2000]; 3p; In English; Association for Research in Otolaryngology, 20-24 Feb. 2000, Saint Petersburg, FL, USA
Contract(s)/Grant(s): NAG5-6329; RTOP 199-16-11-54; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Eight chronic vestibular deficient (VD) patients (bilateral N = 4, unilateral N = 4, ages 18-67 were exposed to an interaural centripetal acceleration of 1 G (resultant 45 degree roll tilt of 1.4 G) on a 0.8 meter radius centrifuge for up to 90 minutes in the dark. The patients sat with head fixed upright, except every 4 of 10 minutes when instructed to point their nose and eyes towards a visual target (switched on every 3 to 5 seconds at random places within plus or minus 30 deg) in the Earth horizontal plane. Eye movements, including directed saccades for subjective Earth-and head-referenced planes, were recorded before, during, and after centrifugation using electro-oculography. Postural sway was measured before and within ten minutes after centrifugation using a sway-referenced or earth-fixed support surface, and with or without a head movement sequence. The protocol was selected for each patient based on the most challenging condition in which the patient was able to maintain balance with eyes closed.

Derived from text

Attitude (Inclination); Inertia; Patients; Vestibules; Gravitation; Body Sway Test; Aerospace Medicine

20000086669 NASA Johnson Space Center, Houston, TX USA

Anesthetic Concerns of Space Flight

Norfleet, William T., NASA Johnson Space Center, USA; [1999]; 8p; In English; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Anesthesiologists are acutely aware of the fact that, although a given surgical procedure may be relatively simple, the required anesthetic care is, in certain cases, extremely complex. This principle is particularly evident when one ponders the difficulties involved in providing even basic anesthetic care in microgravity. In this issue some of these difficulties through the evaluation of airway management techniques during water immersion are confronted, a simulation of the gravito-inertial conditions of space flight. As prelude for this paper, I would like to outline some of the challenges to be overcome before surgical, anesthetic, and critical care can be delivered beyond our home planet.

Derived from text

Anesthetics; Space Flight; Aerospace Medicine

20000088577 Air Force Inst. for Environment, Safety and Occupational Health Risk Analysis, Risk Analysis Directorate, Brooks AFB, TX USA

Assessing Worker Exposures During Abrasive Blasting: Industrial Hygiene Field Guidance for Bioenvironmental Engineers Final Report, 1999-2000

Carlton, Gary N.; England, Ellen C.; Apr. 2000; 47p; In English

Report No.(s): AD-A379770; IERA-RS-BR-TR-2000-0001; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

In the past, it has been difficult to measure worker exposures during abrasive blasting operations. Accepted sampling methods for metals, such as filters in cassettes, results in rapid overloading and shredding of the filter by high-velocity particles projected into the inlet after rebound from the surface being blasted. In addition, non-inhalable particles larger than 100 micrometers are abundant during abrasive blasting and are easily captured by these sampling methods. Analysis of this non-inhalable dust can result in a considerable overestimation of worker exposures to airborne metals. As a result of these concerns, the Industrial Hygiene Branch of the Air Force Institute for Environment, Safety and Occupational Health Risk Analysis (AFIERA) recently completed an Air Force-wide assessment of worker exposures during abrasive blasting operations. The study design, data analysis, and sampler development were accomplished in collaboration with researchers from the University of Cincinnati. This technical report summarizes our recommended sampling methodology, data interpretation, ventilation requirements, personal protective equipment, and workplace practices for abrasive blasting.

DTIC

Environmental Engineering; Hygiene; Exposure; Occupational Diseases; Abrasives; Dust

20000088579 California Univ., Irvine, CA USA

Chemistry and Pharmacology of Long Term Potentiation: Contributions Beyond Synaptic Modification *Final Report, 1 Jun. 1998 - 31 May 1999*

Lynch, Gary; Kessler, M.; Jun. 09, 2000; 6p; In English

Contract(s)/Grant(s): F49620-98-1-0317

Report No.(s): AD-A379775; AFRL-SR-BL-TR-00-0271; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Work from this laboratory demonstrated that receptors with integrity epitopes, and that bind to the consensus RGD (arginine-glycine-aspartate) sequence, are concentrated in forebrain synapses. Light and electron microscopic immunocytochemical experiments from other groups then showed that β_1 subunits are present in hippocampus and that α_1 subunits are highly concentrated in hippocampal synapses. Having established that integrins are indeed located in adult synapses, it was appropriate to ask what subtypes are used by brain and to map their distributions across regions. The question is potentially of considerable importance because the type of outside-in signaling performed by integrins is affected by their subunit composition.

DTIC

Aerospace Medicine; Pharmacology; Synapses

20000088582 Army Medical Research Inst. of Infectious Diseases, Fort Detrick, MD USA

Telemetric Evaluation of Body Temperature and Physical Activity as Predictors of Mortality in a Murine Model of Staphylococcal Enterotoxin Shock

Vlach, Kim D.; Boles, James W.; Stiles, Bradley G.; Jul. 19, 2000; 8p; In English

Report No.(s): AD-A379789; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Background and Purpose: Hypothermia and death are used as experimental markers in murine models of staphylococcal enterotoxins shock. This study determined whether body temperature and physical activity, monitored telemetrically, could predict impending death and provide an earlier, more humane experimental endpoint. Methods: The study consisted of two iterations (experiments 1 and 2) to determine reproducibility of the model. Each experiment consisted of 24 BALB/c mice surgically implanted with intra-abdominal telemetry transmitters lipopolysaccharide (LPS). Core body temperature and physical activity were continuously monitored in all mice for 10 days before, and 5 days after, injections. Additionally, in experiment 2, subcutaneous temperatures were compared with core body temperatures obtained by telemetry. Results: Body temperature and physical activity were reduced in mice after administration of SEB and LPS, or LPS alone, but not SEB only. There was a significant ($P < 0.05$) correlation between mortality and body temperature ($P = 0.0077$), but not physical activity ($P = 0.97$). Conclusion: Body Temperature proved to be an early indicator of mortality in this murine model of staphylococcal enterotoxins shock.

DTIC

Aerospace Medicine; Body Temperature; Physical Exercise; Staphylococcus

20000089706 Virginia Univ., Mechanical and Aerospace Engineering, Charlottesville, VA USA

Magnetic Suspension of an Artificial Heart Pump Using EM/PM Bearings

Allaire, P., Virginia Univ., USA; Decker, J., Virginia Univ., USA; Baloh, M., Virginia Univ., USA; Lee, J., Virginia Univ., USA; Long, J., LDS Hospital, USA; Fifth International Symposium on Magnetic Suspension Technology; July 2000, pp. 259; In English; See also 20000089691; No Copyright; Avail: Issuing Activity; Abstract Only

An artificial heart pump is under development for use as a ventricular assist device. This paper describes a fourth generation prototype pump of diameter 68 mm (2.62 in) and axial length 33.5 mm (1.32 in). The pump is a small centrifugal pump with a shaftless impeller fully supported in magnetic bearings. It is desired that the magnetic support system have high load capacity, be very compact, and have very low power consumption. A hybrid electromagnet/permanent magnet bearing design has been developed and tested. The bearings consist of two identical rings, one placed on the inlet side of the centrifugal impeller and one placed on the discharge side of the impeller. Each ring has eight poles, four radial and four axial, to control the pump impeller in five axes (x, y, z, alpha, beta) - three displacements and two angular displacements relative to the x, y axes. The bearings have a radial load capacity of 9.65 N (2.16 lbf) and an axial load capacity of 19.3 N (4.33 lbf). The dynamic model of the impeller in the magnetic bearings is developed. The estimated coil ohmic power loss in normal operation is less than 5 watts.

Author

Electromagnets; Heart; Magnetic Bearings; Magnetic Suspension; Permanent Magnets; Centrifugal Pumps; Cardiac Ventricles

20000089850 Naval Postgraduate School, Monterey, CA USA

An Empirical Analysis of the Physical Aptitude Exam as a Predictor of Performance on the Physical Readiness Test

Patrick, Robert W., Jr; Jun. 2000; 114p; In English

Report No.(s): AD-A379544; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

The Physical Aptitude Exam, administered to candidates in the Naval Academy admissions process to measure physical aptitude, consists of pullups for men or the flexed arm hang for women, a 300-yard shuttle run, a standing longjump, and a kneeling basketball throw. The Physical Readiness Test, administered semi-annually to all naval personnel including midshipmen, consists of modified situps, pushups, and a 1.5-mile run. The purpose of this research is to determine if the Physical Aptitude Exam predicts performance on the Physical Readiness Test. Naval Academy midshipmen data from the classes of 2002 and 2003 are analyzed to determine if the Physical Aptitude Exam, taken sometime during the application process, predicts performance on the Physical Readiness Test taken during the fall semester of the midshipman's plebe year. This study uses logit and linear regression analysis to identify two significant explanatory variables; pullups/flexed arm hang and shuttle run, which predict Physical Readiness Test performance. Recognizing the factors that predict performance on the Physical Readiness Test may not only increase the number of midshipmen who pass the Naval Academy's fitness test, but also identify candidates at risk of failing the Physical Readiness Test when they become midshipmen.

DTIC

Aptitude; Physical Fitness; Navy; Human Performance

20000089876 NASA Johnson Space Center, Houston, TX USA

Bioavailability and Pharmacodynamics of Promethazine in Human Subjects

Putch, Lakshmi, NASA Johnson Space Center, USA; Flynn, Chris; [2000]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

Space Motion Sickness (SMS) is often treated in space with promethazine (PMZ). Anecdotal reports indicate that the common side effects of drowsiness and decrements in cognitive performance that are associated with PMZ administration (50 mg IM on the ground, are absent or less pronounced in space suggesting that the bioavailability and/or pharmacodynamic behavior of PMZ may be altered during space flight. There are limited flight opportunities available for clinical research in space, the NRA-99, therefore, solicits research required to improve, or answer specific questions about in-flight diagnosis, therapy, and post-flight rehabilitation. We propose here, to establish a noninvasive method for pharmacodynamic and therapeutic assessment of PMZ. The specific objectives of the proposed research are to, 1. Establish a saliva to plasma ratio of PMZ after administration, 2. Estimate the relative bioavailability of the three flight-specific dosage forms of PMZ, and 3. Establish the dose-response relationship of PMZ. We will estimate the bioavailability of intramuscular injection (IM), oral tablets and rectal suppositories in normal subjects during ambulatory and antiorthostatic; bed rest (ABR) conditions using novel stable isotope techniques. Drowsiness, cognitive performance and salivary flow rate will be measured as a function of circulating drug concentrations after administration of three IM doses of PMZ. We will compare and contrast the bioavailability of PMZ during normal and ABR conditions to examine whether or not ABR can simulate changes in drug, absorption and availability similar to those anticipated in a microgravity environment. Results of this study will validate methods for an approved study with this medication awaiting a flight opportunity for manifestation. These data will also provide the much needed information on the dynamics and therapeutic index. of this medication and their implications on crew fatigue and performance in space. Key words: Promethazine, stable isotopes, bioavailability, pharmacodynamics, cognitive performance, antiorthostatic bed rest.

Author

Aerospace Medicine; Clinical Medicine; Microgravity; Motion Sickness; Drugs; Countermeasures; Performance Tests

20000089877 NASA Johnson Space Center, Houston, TX USA

A Comparison of Cilostazol and Pentoxifylline for Treating Intermittent Claudication

Dawson, David L., NASA Johnson Space Center, USA; Cutler, Bruce S., Massachusetts Univ., USA; Hiatt, William R., Colorado Univ., USA; Hobson, Robert W., II, Medicine and Dentistry Univ. of New Jersey, USA; Martin, John D., Martin (John D.), USA; Bortey, Enoch B., Otsuka America Pharmaceuticals, Inc., USA; Forbes, William P., Otsuka America Pharmaceuticals, Inc., USA; Strandness, D. Eugene, Jr., Washington Univ., USA; [1999]; 3p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

A randomized, double-blind, placebo-controlled, parallel-group, phase III multicenter trial was performed to evaluate the relative efficacy and safety of cilostazol and pentoxifylline. The study included 54 outpatient vascular clinics, including sites at Air Force, Veterans Affairs, tertiary care, and university hospitals in the USA. of 922 consenting patients, 698 met the inclusion criteria, were randomized, and received treatment with either cilostazol 100 mg PO twice a day, pentoxifylline 400 mg PO 3 times a day, or placebo. Treatment was double-dummy to ensure study blindness. Efficacy was primarily established by maximal walking distance (MWD), measured with constant-speed, variable-grade treadmill testing, assessed at baseline and at 4, 8, 12,

16, 20, and 24 weeks. Mean MWD of cilostazol-treated patients (n=227) was significantly improved at every visit compared with patients who received pentoxifylline (n=232) or placebo (n=239). After 24 weeks of cilostazol, mean MWD increased 53.9% (107.3 m) from baseline, and the effect had not plateaued. This was better (P is less than 0.001) than the 30.4% (64.4 m) MWD improvement with pentoxifylline. MWD improvement with pentoxifylline was similar (P = 0.82) to that of placebo (64.7 m). Deaths and serious adverse event rates were similar in each group. Common side effects included headache (27.8% with cilostazol, 11.2% with pentoxifylline, 11.7% with placebo), palpitations (17.2% with cilostazol, 2.2% with pentoxifylline, 1.3% with placebo), and abnormal stools. Cilostazol was significantly better than pentoxifylline or placebo for increasing walking distances; pentoxifylline was no better than placebo.

Author

Cardiovascular System; Clinical Medicine; Drugs; Pain; Analgesia; Performance Tests

20000089878 NASA Johnson Space Center, Houston, TX USA

Calcium and Bone Homeostasis During 4-6 Months Space Flight

Smith, Scott M., NASA Johnson Space Center, USA; OBrien, K.; Wastney, M.; Morukov, B.; Larina, I.; Abrams, S.; Lane, H.; Nillen, J.; Davis-Street, J.; [2000]; 1p; In English; Experimental Biology, 15-18 Apr. 2000, San Diego, CA, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Bone and calcium homeostasis are altered by weightlessness. We previously reported calcium studies on three subjects from the first joint US/Russian mission to Mir. We report here data on an additional three male subjects, whose stays on Mir were 4 (n= 1) and 6 (n=2) mos. Data were collected before, during, and after the missions. Inflight studies were conducted at 2-3 mos. Endocrine and biochemical indices were measured, along with 3-wk calcium tracer studies. Percent differences are reported compared to preflight. Ionized calcium was unchanged (2.8 +/-2.1 %) during flight. Calcium absorption was variable inflight, but was decreased after landing. Vitamin D stores were decreased 35 +/-24% inflight, similar to previous reports. Serum PTH was decreased 59 +/-9% during flight (greater than we previously reported), while 1,25(OH)(sub 2)-Vitamin D was decreased in 2 of 3 subjects. Markers of bone resorption (e.g., crosslinks) were increased in all subjects. Bone-specific alkaline phosphatase was decreased (n=1) or unchanged (n=2), while osteocalcin was decreased 34 +/-23%. Previously presented data showed that inflight bone loss is associated with increased resorption and unchanged/decreased formation. The data reported here support these earlier findings. These studies will help to extend our understanding of space flight-induced bone loss, and of bone loss associated with diseases such as osteoporosis or paralysis.

Author

Bone Demineralization; Bone Mineral Content; Calcium; Osteoporosis; Biological Effects; Physiological Effects; Aerospace Medicine; Bioastronautics

20000089879 NASA Johnson Space Center, Houston, TX USA

Vision Aspects of Space Flight

Manuel, Keith, NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA

Report No.(s): ASMA-A-001882-ASMA; No Copyright; Avail: Issuing Activity; Abstract Only

Vision, being one of our most important senses, is critically important in the unique working environment of space flight. Critical evaluation of the astronauts visual system begins with pre-selection examinations resulting in an average of 65% of all medical disqualification's caused by ocular findings. With an average age of 42, approximately 60% of the astronaut corps requires vision correction. Further demands of the unique training and working environment of microgravity, variable lighting from very poor to extreme brightness of sunlight and exposure to extremes of electromagnetic energy results in unique eyewear and contact lens applications. This presentation will describe some of those unique eyewear and contact lens applications used in space flight and training environments. Additionally, ocular findings from 26 shuttle and 5 MIR mission post-flight examinations will be presented.

Author

Astronauts; Space Missions; Eye (Anatomy); Vision; Visual Acuity; Aerospace Medicine

20000089880 NASA Johnson Space Center, Houston, TX USA

Dietary Sodium Effects on Bone Loss and Calcium Metabolism During Bed Rest

Smith, Scott M., NASA Johnson Space Center, USA; Arnaud, Sara B., NASA Ames Research Center, USA; Abrams, Steven A., Baylor Coll. of Medicine, USA; [2000]; 1p; In English

Report No.(s): NRA-99-HEDS-03; No Copyright; Avail: Issuing Activity; Abstract Only

The acceleration of age-related bone loss is one of the most detrimental effects of space flight. The ability to understand and counteract this loss will be critical for crew health and safety during and after long-duration missions. Studies in healthy ambulatory individuals have linked high salt (sodium) diets, hypercalciuria, and increased renal stone risk. Dietary salt may modulate bone loss through changes in calcium metabolism and the calcium endocrine system. The research proposed here will determine the role of dietary salt in the loss of bone during simulated space flight. Calcium metabolism will be determined through calcium kinetics studies, endocrine and biochemical measurements; and estimates of the mass, distribution and mechanical properties of bone, in subjects fed low (100 mmol sodium/day) or high (250 mmol sodium/day) levels of dietary salt during 28 days of head-down tilt bedrest. This research addresses the role of dietary salt in the loss of bone and calcium in space flight, and integrates the changes in calcium metabolism with those occurring in other physiologic systems. These data will be critical for both countermeasure development, and in determination of nutritional requirements for extended-duration space flight. The potential countermeasures resulting from this research will reduce health risks due to acceleration of age-related osteoporosis and increased risk of renal stone formation..

Author

Aerospace Medicine; Bed Rest; Bone Demineralization; Calcium Metabolism; Osteoporosis; Sodium; Bioastronautics

20000089892 Institute of Sound and Vibration Research, Human Sciences Group, Southampton, UK

Motion Sickness History Questionnaire

Griffin, M. J., Institute of Sound and Vibration Research, UK; Howarth, H. V. C., Institute of Sound and Vibration Research, UK; May 2000; 36p; In English

Report No.(s): ISVR-TR-283; Copyright; Avail: Issuing Activity

A motion sickness susceptibility questionnaire and a means of scoring responses to the questionnaire are presented. The questionnaire records individual exposure to motion in various forms of transport (cars, buses, coaches, small boats, ships, airplanes, trains) and the occurrence of illness and vomiting in these forms of transport during the past year. Various symptoms (feeling hot or sweating, headaches, change of skin colour, mouth watering, drowsiness, dizziness, nausea, vomiting) ever experienced in these forms of transport are obtained, in addition to subject avoidance of the forms of transport and a self-rating of susceptibility to motion sickness. The questionnaire responses are used to determine various measures of motion exposure and susceptibility to motion sickness (i.e. travel frequency in the past year, illness frequency while travelling in past year, vomiting frequency in past year, illness susceptibility in past year, vomiting susceptibility in past year, total susceptibility to vomiting, total susceptibility to motion sickness, susceptibility to motion sickness in land transport, susceptibility to motion sickness in non-land transport). The questionnaire has been used in various experimental studies to allow for individual variations in susceptibility to motion sickness when selecting subjects for experimental investigations. The questionnaire has also been used to relate sickness caused by specific laboratory stimuli to subject susceptibility to motion sickness in various forms of transport. This report also presents an illness rating scale and a symptom checklist used in laboratory experiments of motion sickness.

Author

Motion Sickness; Physiological Effects; Surveys; Acceleration Stresses (Physiology)

20000089912 Krug Life Sciences, Inc., Houston, TX USA

Psychological and Behavioral Health Issues of Long-Duration Space Missions

Eksuzian, Daniel J., Krug Life Sciences, Inc., USA; Life Support and Biosphere Science; 1998; ISSN 1069-9422; Volume 6; 4p; In English; Copyright; Avail: Issuing Activity

It will be the responsibility of the long-duration space flight crew to take the actions necessary to maintain their health and well-being and to cope with medical emergencies without direct assistance from support personnel, including maintaining mental health and managing physiological and psychological changes that may impair decision making and performance. The Behavior and Performance Integrated Product Team at Johnson Space Center, working, within the Space Medicine, Monitoring, and Countermeasures Program, has identified critical questions pertaining to long-duration space crew behavioral health, psychological adaptation, human factors and habitability, and sleep and circadian rhythms. Among the projects addressing these questions are: the development of tools to assess cognitive functions during space missions; the development of a model of psychological adaptation in isolated and confined environments; tools and methods for selecting individuals and teams well-suited for long-duration missions; identification of mission-critical tasks and performance evaluation; and measures of sleep quality and correlation to mission performance.

Author

Long Duration Space Flight; Mental Health; Psychological Factors; Spacecrews; Flight Stress (Biology); Astronaut Performance; Space Psychology; Psychological Effects; Human Behavior; Aerospace Medicine

20000089917 Brigham and Women's Hospital, Boston, MA USA

Clinical Trial of the Effect of Exercise on Resetting of the Endogenous Circadian Pacemaker *Final Report, Jan.-Dec. 1999*

Czeisler, Charles A.; Hughes, Rod J.; May 18, 2000; 8p; In English

Contract(s)/Grant(s): F49620-97-1-0246

Report No.(s): AD-A379262; AFRL-SR-BL-TR-00-0279; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

The objectives of the research effort have not changed; they remain as follows: Specific Aim 1, test the hypothesis that a 9-hr phase delay shift of the duty-rest schedule, such as that required for either transmeridian travel or night operations, will induce physiologic maladaptation in the endogenous circadian rhythms of core body temperature, plasma melatonin, reaction time, alertness and performance; Specific Aim 2, test the hypothesis that multiple nightly bouts of exercise will induce significant delays in the endogenous circadian rhythms of core body temperature, plasma - melatonin, reaction time, alertness and performance relative to the control group, even in the absence of properly timed exposure to photic cues; Specific Aim 3, test the hypothesis that exercise-induced phase delay shifts of will facilitate adaptation of these rhythms to an imposed duty-rest schedule, thereby improving sleep efficiency during daytime sleep and improve reaction time, alertness and performance during scheduled waketime at night relative to control group.

DTIC

Physical Exercise; Circadian Rhythms; Reaction Time; Physiological Factors

20000092440 Civil Aeromedical Inst., Oklahoma City, OK USA

Abnormal Glucose Levels Found in Transportation Accidents *Final Report*

Canfield, Dennis V., Civil Aeromedical Inst., USA; Chaturvedi, Arvind K., Civil Aeromedical Inst., USA; Boren, Henry K., Civil Aeromedical Inst., USA; Veronneau, Stephen J. H., Civil Aeromedical Inst., USA; White, Vicky L., Civil Aeromedical Inst., USA; June 2000; 16p; In English

Contract(s)/Grant(s): AM-B-98-TOX-202

Report No.(s): DOT/FAA/AM-00/22; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The Federal Aviation Administration's Office of Aviation Medicine (OAM) is responsible for the certification of pilots with diabetic conditions. Therefore, it is essential for OAM to monitor pilots involved in fatal accidents for abnormal glucose levels, which might have caused performance impairment/ incapacitation. The present study evaluated the use of postmortem vitreous humor and urine glucose levels in transportation accident fatalities as indicators of potentially incapacitating medical conditions or performance impairment. Methods. Vitreous humor and/or urine from 192 accident fatalities were analyzed for glucose using a hexokinase method. Cases with values below the lower limit of detection (10 mg/dL) and above 3 standard deviations (SD) from the mean were not included in the final statistics. AN cases more than 5 SD above the mean were deemed abnormal and a full case history was evaluated based on the available medical history. Results. The mean glucose concentration was 30 mg/dL (SID: 21 mg/dL) from 98 postmortem vitreous humor specimens, while it was 27 mg/dL (SID: 16 mg/dL) from 127 postmortem urine samples. Nine of the 192 cases were identified as having abnormal glucose levels. Abnormal glucose levels were found in 5 of the 8 cases with a known diabetic condition. Glycosuria or low renal threshold was reported in 2 fatal pilots; 1 of these pilots had an abnormal glucose level. Conclusions. Hyperglycemia can be established from the vitreous humor and urine glucose levels, but hypoglycemia cannot, because of the rapid postmortem drop in vitreous humor glucose levels. All of the pilot abnormal glucose cases detected were previously identified during the medical certification process or had a medical reason for the abnormal level. The elevated vitreous humor and urine glucose levels have proven useful in identifying individuals with a pre-existing diabetic condition that might have been a factor in the accident.

Author

Glucose; Abnormalities; Certification; Hyperglycemia; Hypoglycemia; Management

20000093970 Virginia Univ., Dept. of Biology, Charlottesville, VA USA

Effects of the TAU Mutation on Circadian Organization *Final Report, 1 Jan.-30 Nov. 1998*

Menaker, Michael; Nov. 30, 1998; 50p; In English

Contract(s)/Grant(s): F49620-98-1-0174

Report No.(s): AD-A379434; AFRL-SR-BL-TR-00-0296; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

As a consequence of the abbreviated grant period (11 months), we did not make as much progress as we anticipated in our original 3-year proposal. We finished and published a study on c-fos expression in the SCN of tau mutant hamsters. We demonstrated a correlation between phase-shifting and Fos induction thresholds under conditions where both responses are dramatically altered by the previous light history, suggesting a casual association between changes in behavioral phase shifting and c-fos in the SCN. We finished and published a lengthy study of multiunit electrical activity (MUA) rhythms recorded from the SCN and other brain areas of awake, behaving hamsters. The study was something of a technical tour-de-force. There are only

one or two others like it in the circadian literature. We modeled the pacemaker system of the tau mutant hamster using computer simulation. These simulations led to two primary conjectures: (1) the total amplitude of the pacemaker system in tau mutant hamsters is less than in wild type animals, and (2) the coupling between the unit E and M oscillators is weakened during continuous exposure of hamsters to DD.

DTIC

Circadian Rhythms; Computerized Simulation; Exposure; Mutations

~~20000094005~~ Civil Aeromedical Inst., Oklahoma City, OK USA

Refractive Surgery in Aircrew Members Who Fly for Scheduled and Nonscheduled Civilian Airlines *Final Report*

Nakagawara, Van B., Civil Aeromedical Inst., USA; Wood, Kathryn J., Civil Aeromedical Inst., USA; Montgomery, Ronald W., Civil Aeromedical Inst., USA; May 2000; 14p; In English

Contract(s)/Grant(s): AM-A-99-TOX-203

Report No.(s): DOT/FAA/AM-00/19; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Civil airmen with refractive surgery are present in all classes of aeromedical certificate holders. Refractive surgical procedures have been associated with numerous side effects, including glare, reduced contrast sensitivity, and fluctuating visual acuity. These side effects may render the quality of vision unacceptable in the cockpit environment. This study reviews the aeromedical certification experience with refractive surgery in aircrew members who fly for civilian airlines. Methods. Active airmen with FAA-specific pathology codes 130 (radial keratotomy) and 5179 (general eye pathology with surgical prefix) in the Consolidated Airman Information System medical database during the period 1 January 1994 through 31 December 1996 were identified. Airmen were stratified into those with a first-class medical certificate, an occupational code 1 (pilot, copilot, first, and second officer) or code 2 (flight engineer), and an employer code of a scheduled or nonscheduled airline. The medical records of these airmen were reviewed, and the clinical data were collated and analyzed. Results. A total of 133 flight crewmembers (125 pilots and 8 flight engineers) were identified as employees of airlines and having had refractive surgery. Seventeen airmen (12.8%) were miscoded and 2 airmen (1.5%) were lost to follow-up. of the 114 pilots with refractive surgery, 97 (85.1 %) were incisional procedures, 15 (13.2%) were laser procedures, and 2 (1.7%) were complex surgical procedures. Three airmen (2.6%) had serious complications resulting from the refractive procedure, including postoperative stromal haze, depth perception problems, and a perforated cornea and crystalline lens resulting in a cataract. Conclusions. The preponderance of aircrew members who have had refractive surgery and fly for scheduled or nonscheduled airlines have incisional refractive procedures, which reportedly have the most critical visual side effects. A considerable number of airmen have had laser procedures, of which the long-term effects are still unknown. Although some serious complications have resulted from refractive surgery, the study indicates these complications have not affected an applicant's ability to receive an airman medical certificate.

Author

Aerospace Medicine; Aircraft Pilots; Cataracts; Cornea; Eye (Anatomy); Visual Acuity

~~20000094303~~ NASA Johnson Space Center, Houston, TX USA

Spatial Orientation and Balance Control Changes Induced by Altered Gravito-Inertial Force Vectors

Kaufman, Galen D., NASA Johnson Space Center, USA; Wood, Scott J., Baylor Coll. of Medicine, USA; Gianna, Claire C., Legacy Health System, USA; Black, F. Owen, Legacy Health System, USA; Paloski, William H., NASA Johnson Space Center, USA; [1999]; 2p; In English

Contract(s)/Grant(s): NAG5-6329; RTOP 199-16-11-54; No Copyright; Avail: Issuing Activity; Abstract Only

Seventeen healthy and eight vestibular deficient subjects were exposed to an interaural centripetal acceleration of 1 G (resultant 45 deg roll tilt of 1.4 G) on a 0.8 meter radius centrifuge for a period of 90 minutes in the dark. The subjects sat with head fixed upright, except every 4 of 10 minutes when instructed to rotate their head so that their nose and eyes pointed towards a visual point switched on every 3 to 5 seconds at random places (within +/- 30 deg) in the Earth horizontal plane. Motion sickness caused some subjects to limit their head movements during significant portions of the 90 minute period, and led three normal subjects to stop the test earlier. Eye movements, including directed saccades for subjective Earth- and head-referenced planes, were recorded before, during, and immediately after centrifugation using electro-oculography. Postural stability measurements were made before and within ten minutes after centrifugation. In normal subjects, postural sway and multisegment body kinematics were gathered during an eyes-closed head movement cadence (sway-referenced support platform), and in response to translational/rotational platform perturbations. A significant increase in postural sway, segmental motion amplitude and hip frequency was observed after centrifugation. This effect was short-lived, with a recovery time of several postural test trials. There were also asymmetries in the direction of post-centrifugation center of sway and head tilt which depended on the subject's orientation during the centrifugation adaptation period (left ear or right ear out). to delineate the effect of the magnitude of the gravito-inertial vector versus its direction during the adaptive centrifugation period, we tilted eight normal subjects in the roll axis

at a 45 deg angle in the dark for 90 minutes without rotational motion. Their postural responses did not change following the period of tilt. Based on verbal reports, normal subjects overestimated roll-tilt during 90 minutes of both tilt and centrifugation stimuli. Subjective estimates of head-horizontal, provided by directed saccades, revealed significant errors after approximately 30 minutes that tended to increase only in the group who underwent centrifugation. Immediately after centrifugation, subjects reported feeling tilted on average 10 degrees in the opposite direction, which was in agreement with the direction of their earth-directed saccades. In vestibular deficient (VD) subjects, postural sway was measured using a sway-referenced or earth-fixed support surface, and with or without a head movement sequence. 'Me protocol was selected for each patient during baseline testing, and corresponded to the most challenging condition in which the patient was able to maintain balance with eyes closed. Bilaterally VD subjects showed no postural decrement after centrifugation, while unilateral VD subjects had varying degrees of decrement. Unilateral VD subjects were tested twice; they underwent centrifugation both with right ear out and left ear out. Their post-centrifugation center of sway shifted at right angles depending on the centrifuge GIF orientation. Bilateral VD subjects had shifts as well, but no consistent directional trend. VD subjects underestimated roll-tilt during centrifugation. These results suggest that orientation of the gravito-inertial vector and its magnitude arc both used by the central nervous system for calibration of multiple orientation systems. A change in the background gravito-inertial force (otolith input) can rapidly initiate postural and perceptual adaptation in several sensorimotor systems, independent of a structured visual surround.

Author

Otolith Organs; Horizontal Orientation; Vertical Orientation; Human Performance

53

BEHAVIORAL SCIENCES

Includes psychological factors; individual and group behavior; crew training and evaluation; and psychiatric research.

20000085167 NASA Johnson Space Center, Houston, TX USA

Head and Trunk Movement Control During Locomotion After Long-Duration Spaceflight

Bloomberg, Jacob J., NASA Johnson Space Center, USA; Paige, Gary D., Rochester Univ., USA; Mulavara, A. P.; McDonald, P. V.; Layne, C. S.; Merkle, L. A.; Kozlovskaya, I. B.; [1999]; 1p; In English; 9th; Vestibular Influences on Spatial Orientation, 16-19 Apr. 1999, Princeville, HI, USA; Sponsored by Society for the Neural Control of Movement, USA; No Copyright; Avail: Issuing Activity; Abstract Only

Exposure to the microgravity environment encountered during spaceflight induces adaptive alteration in sensorimotor function that leads to postflight disturbances in locomotor control. Head and trunk movement control plays a central role in maintaining gaze stability and in providing a stable reference system to permit spatial navigation in a complex and constantly varying environment. The goal of the present study was to investigate the effects of long-duration spaceflight (3-6 months) on head and trunk movement control during postflight terrestrial locomotion. Before and after spaceflight, subjects walked on a motorized treadmill while performing a challenging gaze stabilization task requiring number recognition. Head and trunk kinematic data were collected with a video-based motion analysis system. Analysis of roll, pitch and yaw head and trunk movements during treadmill walking revealed postflight alterations in head and trunk movement control in all three planes of motion. Subjects also experienced oscillopsia during postflight walking which led to impairment in performance of the number recognition task. These data indicate that exposure to long-duration space flight causes alteration in head and trunk movement control during postflight locomotion. These changes have implications for the control of gaze and maintenance of dynamic stability during walking after long-duration spaceflight.

Author

Dynamic Stability; Exposure; Microgravity; Head Movement; Maintenance

20000085613 Civil Aeromedical Inst., Oklahoma City, OK USA

The Effects of Performance Feedback on Air Traffic Control Team Coordination: A Simulation Study *Final Report*

Bailey, Larry L., Civil Aeromedical Inst., USA; Thompson, Richard C., Civil Aeromedical Inst., USA; July 2000; 16p; In English Contract(s)/Grant(s): AM-B-99-HRR-518

Report No.(s): DOT/FAA/AM-00/25; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

This study examines the efficacy of team members observing a computer playback of their performance as a training tool in building effective air traffic control (ATC) teams. Participants performed various simulated radar-based ATC tasks under varying levels of aircraft density. The results suggest that observing a computer playback of one's team performance enabled team members to gain a system's perspective of how their performance both affects and is affected by others. This perspective enabled team members to better coordinate their individual efforts, which thereby led to improvements in team cohesion and in the

percentage of aircraft that reached their destination within the time constraints of a given scenario. However, as aircraft density increased, these improvements began to diminish. Additional specialized training may be necessary for ATC teams to improve their coordination during periods of high workload.

Author

Air Traffic Control; Feedback Control; Playbacks; Control Simulation; Human Performance

20000085879 NASA Ames Research Center, Moffett Field, CA USA

Cooperation and Coordination Between Fuzzy Reinforcement Learning Agents in Continuous State Partially Observable Markov Decision Processes

Berenji, Hamid R., NASA Ames Research Center, USA; Vengerov, David, NASA Ames Research Center, USA; Jun. 14, 1999; 8p; In English; 8th; Fuzzy Systems, 22-25 Aug. 1999, Seoul, Korea, Republic of; Sponsored by Institute of Electrical and Electronics Engineers, USA; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Successful operations of future multi-agent intelligent systems require efficient cooperation schemes between agents sharing learning experiences. We consider a pseudo-realistic world in which one or more opportunities appear and disappear in random locations. Agents use fuzzy reinforcement learning to learn which opportunities are most worthy of pursuing based on their promise rewards, expected lifetimes, path lengths and expected path costs. We show that this world is partially observable because the history of an agent influences the distribution of its future states. We consider a cooperation mechanism in which agents share experience by using and-updating one joint behavior policy. We also implement a coordination mechanism for allocating opportunities to different agents in the same world. Our results demonstrate that K cooperative agents each learning in a separate world over N time steps outperform K independent agents each learning in a separate world over K*N time steps, with this result becoming more pronounced as the degree of partial observability in the environment increases. We also show that cooperation between agents learning in the same world decreases performance with respect to independent agents. Since cooperation reduces diversity between agents, we conclude that diversity is a key parameter in the trade off between maximizing utility from cooperation when diversity is low and maximizing utility from competitive coordination when diversity is high.

Author

Markov Processes; Coordination; Smart Materials

20000085936 NASA Johnson Space Center, Houston, TX USA

Screening for Psychopathology Versus Selecting for Suitability: Ethical and Legal Considerations

Holland, Albert W., NASA Johnson Space Center, USA; Galarza, Laura, Wyle Labs., Inc., USA; Arvey, Richard, Minnesota Univ., USA; Hysong, Sylvia, Wyle Labs., Inc., USA; Sackett, Paul, Minnesota Univ., USA; Cascio, Wayne, Colorado Univ., USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The current system for psychological selection of U.S. astronauts is divided into two phases: The select-out phase and the select-in phase. The select-out phase screens candidates for psychopathology; candidates who do not meet the baseline psychiatric requirements are immediately disqualified. The select-in phase assesses candidates for suitability to fly short- and long-duration missions. Suitability ratings are given for ten factors found to be critical for short and long-duration space missions. There are qualitative differences in the purpose of the two phases (select-in vs. select-out) and in the nature of the information collected in each phase. Furthermore, there are different logistic, ethical, and legal issues related to a medical or psychiatric (select-out) screening versus a suitability (select-in) psychological screening process. The purpose of this presentation is to contrast the ethical and legal environment surrounding the select-out and select-in phases of the psychological selection system. Issues such as data collection, data storage and management, the federal statutory environment, and personnel training will be discussed. Further, a summary of the new standards for psychological testing is presented, along with their implications for astronaut selection.

Author

Psychological Tests; Data Acquisition; Astronauts

20000085939 Wyle Labs., Inc., USA

Psychological Selection of NASA Astronauts for International Space Station Missions

Galarza, Laura, Wyle Labs., Inc., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

During the upcoming manned International Space Station (ISS) missions, astronauts will encounter the unique conditions of living and working with a multicultural crew in a confined and isolated space environment. The environmental, social, and mission-related challenges of these missions will require crewmembers to emphasize effective teamwork, leadership, group living and self-management to maintain the morale and productivity of the crew. The need for crew members to possess and display skills and behaviors needed for successful adaptability to ISS missions led us to upgrade the tools and procedures we use for astronaut

selection. The upgraded tools include personality and biographical data measures. Content and construct-related validation techniques were used to link upgraded selection tools to critical skills needed for ISS missions. The results of these validation efforts showed that various personality and biographical data variables are related to expert and interview ratings of critical ISS skills. Upgraded and planned selection tools better address the critical skills, demands, and working conditions of ISS missions and facilitate the selection of astronauts who will more easily cope and adapt to ISS flights.

Author

Personality; Leadership; Crews; Confinement; Astronauts; Adaptation; Psychological Factors

20000085940 Wyle Labs., Inc., USA

Psychological Selection of NASA Astronauts for International Space Station Missions

VanderArk, Steve, Wyle Labs., Inc., USA; Curtis, Kelly D., Wyle Labs., Inc., USA; [1999]; 1p; In English; No Copyright; Avail: Issuing Activity; Abstract Only

During the relatively short-duration Space Shuttle missions, a psychological support program for the astronauts has not been required. Such missions primarily require providing occasional communication with family members by means of audio, video or e-mail, and some diversions such as CD players. During the NASA-Mir Program, conducted from March 1995 through June 1998, mission duration increased to 4-6 months. As a result of these changes it was necessary for NASA to establish an operational Human Behavior and Performance Group (HBPG) to develop and implement a comprehensive program of psychological support. The Mir experience provided the opportunity to develop and implement a psychological support program for long-duration space missions. Many factors influence the support program, including individual preferences, mission duration, and environmental factors such as habitable and personal areas. Lessons learned from the Mir experience are being applied to improve the ISS psychological support program plan. This presentation will address which includes various preflight, in-flight, and post-flight support activities and tools that NASA's HBPG will provide to astronauts and their families for ISS missions.

Author

Psychological Factors; Astronauts; Habitability; Human Behavior; Space Missions

20000085964 NASA Johnson Space Center, Houston, TX USA

Forty Years of Psychological and Psychiatric Selection of NASA Astronauts

Holland, Albert W., NASA Johnson Space Center, USA; [2000]; 1p; In English, 14-18 May 2000, Houston, TX, USA; Sponsored by Aerospace Medical Association, USA; No Copyright; Avail: Issuing Activity; Abstract Only

The purpose of this presentation is to chronicle the history and development of the psychological selection process for NASA astronauts. For over 40 years, astronaut applicants have undergone rigorous medical testing to qualify for candidacy. Psychological selection has an equally long history, dating back to 1958, when psychological requirements were established for astronauts during the Mercury program. However, for many years, psychological selection consisted of psychiatric screening for psychopathology. As we approach the day in which the first ISS crew will live and work in space for months at a time, it becomes clear that both the psychological criteria and the selection system to detect said criteria have changed. This presentation discusses the events that led to the current, dual-phase selection system that is used to select individuals into the astronaut corps. Future directions for psychological selection will also be addressed.

Author

Astronauts; Psychology; Psychiatry; Aerospace Medicine; NASA Space Programs

20000086663 NASA Johnson Space Center, Houston, TX USA

Reflections on Descriptive Psychology: NASA, Media and Technology, Observation

Aucoin, Paschal J., Jr., NASA Johnson Space Center, USA; [1999]; 11p; In English; 21st, Sep. 1999, Pensacola, FL, USA; Sponsored by Society for Descriptive Psychology, Unknown

Contract(s)/Grant(s): NAS9-19100; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

At NASA, we have used methods of Descriptive Psychology (DP) to solve problems in several areas: Simulation of proposed Lunar/Mars missions at high level to assess feasibility and needs in the robotics and automation areas. How we would go about making a "person-like" robot. Design and implementation of Systems Engineering practices on behalf of future projects with emphasis on interoperability. Design of a Question and Answer dialog system to handle student questions about Advanced Life Support (ALS) systems - students learn biology by applying it to ALS projects.

Author

Psychology; Systems Engineering; Robots; Robotics

20000088511 Air Force Research Lab., Mesa, AZ USA

USAF Pilot Selection *Final Report, Apr. 1996-Apr. 1998*

Weeks, Joseph L., Air Force Research Lab., USA; Apr. 2000; 21p; In English; Pub. in Proceedings of Shephard Air Power Training Conference, London, UK, 2-3 Apr 1998.

Contract(s)/Grant(s): F41624-95-D-5030; AF Proj. 1123

Report No.(s): AD-A379329; AFRL-HE-AZ-TP-2000-0004; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

For USAF flying training, there are seven points of entry which include the three commissioning sources (i.e., Air Force Academy, AFA; Reserve Officer Training Corps, ROTC; and Officer Training School, OTS), entry from active duty, Air National Guard, Air Force Reserves, and entry from international sources. Pilot qualification and selection standards differ across points of entry. Selection policies for AFA, ROTC, OTS, and active duty are described because these points of entry provide the majority of entrants to pilot training. For these points of entry, selection procedures are described and several studies of selection procedures are outlined. Applicant information provided to selection boards and the applicant attributes that are most important for pilot selection decisions are discussed. The impact of current selection policy on student quality is discussed and the interdependent influences of student quality, pilot production rates, and training difficulty on flying training attrition are examined.

DTIC

Armed Forces (USA); Pilot Selection; Flight Training; Personnel; Qualifications

20000089927 Air Force Research Lab., Human Effectiveness Directorate, Mesa, AZ USA

Unmanned Aerial Vehicle Operator Qualifications, *Jan. 1999 - Jan. 2000*

Weeks, Joseph L.; Mar. 2000; 20p; In English

Contract(s)/Grant(s): AF Proj. 2313

Report No.(s): AD-A379424; AFRL-HE-AZ-TR-2000-0002; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

There are large differences in operator qualifications for unmanned aerial vehicles (UAVs) operated by the Department of Defense. These differences were examined to identify underlying causes. For tactical UAVs operated by the US Navy, Marine Corps, and Army, specially trained enlisted personnel may qualify as internal pilot. Flight experience in manned aircraft is not required. For the medium-altitude endurance UAV employed by the USAF, only officers who are pilots of manned aircraft or navigators holding a commercial pilot's license with an instrument rating may qualify as internal pilot. The interaction of UAV flight capabilities and federal aviation guidelines underlie these differences. Although service policy and federal aviation guidelines determine operator qualifications, research into the essential skills of UAV operators is needed. Knowledge of essential skills would guide design of training and identify human performance issues associated with mission execution. Knowledge of essential skills will serve as the frame of reference for research into the performance effects of mission length, night-time operations, and circadian dysrhythmia. Development of remedial training and cueing technologies could follow as strategies for minimizing adverse effects on mission performance.

DTIC

Qualifications; Unmanned Spacecraft; Operators (Personnel); Flight Characteristics; Dast Program

20000092064 Research and Technology Organization, Human Factors and Medicine Panel, Neuilly-sur-Seine, France

Kingdom in the Sky - Earthly Fetters and Heavenly Freedoms. The Pilot's Approach to the Military Flight Environment
le Royaume au Ciel - Fers Terrestres et Libertes Celestes. La Demarche du Pilote vis a vis de l'Environnement Aeronautique Operationnel

Ponomarenko, V., Research and Technology Organization, France; Boubel, T., Editor, Research and Technology Organization, France; Ercoline, W., Editor, Research and Technology Organization, France; July 2000; 162p; In English; CD-ROM contains full text document in PDF format; Translator: I. Malinin

Report No.(s): RTO-AG-338; AC/323[HFM]TP/5; ISBN 92-837-1041-X; Copyright Waived; Avail: CASI; A08, Hardcopy; C01, CD-ROM

This book provides insight from a Russian perspective into the psychology of the flyers (pilot and other aircrew members), and their constant struggle to cope with the procedures dictated by ground-based directors while enjoying the thrill and emotional high of flight. The author takes the reader through the turmoil of flight emergencies, unpopular ground-directed missions, and, ultimately, aircraft mishaps. He describes the difficult conditions placed upon the flyers by a system inadequately prepared to address human factor issues, and points out that it is the responsibility of those on the ground to improve the conditions of the flyer. Those improvements can come from knowledge based on research and appreciation of the flyers' mission. Chapter 1 provides details of the problems associated with aircraft accident investigations and the impact these can have on the flyer's dignity. Chapter 2 describes many of the dangers associated with flight, as well as the skills necessary to overcome those hazards. Chapter 3 describes the current state of human factor issues and flight safety. Chapter 4 deals with ergonomics and their relationship with

flight safety. Chapter 5 matches the role of the flight surgeon with the operational requirements of the flyers. Chapter 6 identifies the problems encountered when one is too conservative toward a profession that requires radical, rapid, and sometimes fatal in flight decisions. Chapter 7 explains how the flyer can maintain a healthy body and mind. Chapter 8 summarizes the research and lessons learned by the author while working with the flyer and within the establishment.

Author

Aircraft Accident Investigation; Flight Safety; Flight Crews; Aviation Psychology; Aircraft Accidents; Pilot Training; Russian Federation; Histories

~~20000094300~~ Raytheon Training and Services Co., Mesa, AZ USA

Head and Eye Movements in Free Visual Search: Effects of Restricted Field of View and Night Vision Goggle Imagery
Final Report, Sep. 1998-Sep. 1999

Geri, George A., Raytheon Training and Services Co., USA; Wetzel, Paul A., Raytheon Training and Services Co., USA; Martin, Elizabeth L., Air Force Research Lab., USA; Dec. 1999; 137p; In English

Contract(s)/Grant(s): F41624-97-D-5000; AF Proj. 2743

Report No.(s): AD-A379370; AFRL-HE-AZ-TR-1999-0249; No Copyright; Avail: CASI; A02, Microfiche; A07, Hardcopy

Combined head and eye movements were measured as observers searched for simple grating targets (2 degrees or 6 degrees dia.) super-imposed on each of two levels of background detail, using each of three instantaneous fields of view (IFOV) (IFOV = 10, 20 or 40 degrees) The relevant data were the pattern of head movements and the magnitude, direction, and fixation duration of gaze saccades. In addition, a separate set of observers performed the same search task using real night vision goggles (NVGs) (IFOV = 38 degrees). It was found that increasing the IFOV resulted in a decrease in the magnitude of head movements and a concomitant increase in the magnitude of eye movements. This apparent tradeoff suggests that only about 10 degrees of the visual periphery was effectively used in the visual search, Head scans and gaze magnitudes were independent of either the size of the test target or the level of background detail. Fixation duration was dependent on target size but only at the smallest IFOV. Saccadic duration was also plotted as a function of saccade magnitude (i.e., the main sequence), and we found that a power function with an exponent of about 0.35 gave the best fit to these data. Finally, the similarity of the data obtained in the IFOV =40 degrees condition and those obtained using real NVGs (IFOV =38 degrees) suggests that the conclusions reached here may be generalized to visual search performed with real NVGs under the stimulus conditions tested here.

DTIC

Night Vision; Head (Anatomy); Head Movement; Saccadic Eye Movements; Goggles; Imagery

54

MAN/SYSTEM TECHNOLOGY AND LIFE SUPPORT

Includes human factors engineering; bionics, man-machine, life support, space suits and protective clothing. For related information see also 16 Space Transportation and 52 Aerospace Medicine..

~~20000081720~~ NASA Johnson Space Center, Houston, TX USA

Terrestrial EVA Suit = Fire Fighter's Protective Clothing

Foley, Tico, NASA Johnson Space Center, USA; Brown, Robert G., NASA Johnson Space Center, USA; Burrell, Eddie, NASA Johnson Space Center, USA; DelRosso, Dominic, NASA Johnson Space Center, USA; Krishen, Kumar, NASA Johnson Space Center, USA; Moffitt, Harold, NASA Johnson Space Center, USA; Orndoff, Evelyne, NASA Johnson Space Center, USA; Santos, Beatrice, NASA Johnson Space Center, USA; Butzer, Melissa, Oceaneering Space Systems, USA; Dasgupta, Rajib, Lockheed Martin Corp., USA; [1999]; 6p; In English; International Conference on Environmental Systems (ICES), 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Report No.(s): Rept-1999-01-1964; No Copyright; Avail: CASI; A02, Hardcopy; A01, Microfiche

Firefighters want to go to work, do their job well, and go home alive and uninjured. For their most important job, saving lives, firefighters want protective equipment that will allow more extended and effective time at fire scenes in order to perform victim search and rescue. A team, including engineers at NASA JSC and firefighters from Houston, has developed a list of problem areas for which NASA technology and know-how can recommend improvements for firefighter suits and gear. Prototypes for solutions have been developed and are being evaluated. This effort will spin back to NASA as improvements for lunar and planetary suits.

Author

Protective Clothing; Technology Transfer; Fire Fighting; Extravehicular Activity; Space Suits

20000081742 NASA Johnson Space Center, Houston, TX USA

Space Suit Thermal Dynamics

Campbell, Anthony B., Missouri Univ., USA; Nair, Satish S., Missouri Univ., USA; Miles, John B., Missouri Univ., USA; Iovine, John V., Lockheed Martin Space Systems Co., USA; Lin, Chin H., NASA Johnson Space Center, USA; [1998]; 32p; In English Contract(s)/Grant(s): NAG9-915; PWC-260981; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

The present NASA space suit (the Shuttle EMU) is a self-contained environmental control system, providing life support, environmental protection, earth-like mobility, and communications. This study considers the thermal dynamics of the space suit as they relate to astronaut thermal comfort control. A detailed dynamic lumped capacitance thermal model of the present space suit is used to analyze the thermal dynamics of the suit with observations verified using experimental and flight data. Prior to using the model to define performance characteristics and limitations for the space suit, the model is first evaluated and improved. This evaluation includes determining the effect of various model parameters on model performance and quantifying various temperature prediction errors in terms of heat transfer and heat storage. The observations from this study are being utilized in two future design efforts, automatic thermal comfort control design for the present space suit and design of future space suit systems for Space Station, Lunar, and Martian missions.

Author

Dynamic Models; Thermal Comfort; Extravehicular Mobility Units; Temperature Control; Thermal Environments; Automatic Control

20000083907 Institute of Space Medico-Engineering, Beijing, China

Thermal Physiological Consideration of Precooling Procedures in Manned Space Craft

Yu, Xue-Jun, Institute of Space Medico-Engineering, China; Chang, Shao-Yong, Institute of Space Medico-Engineering, China; Wu, Jian-Min, Institute of Space Medico-Engineering, China; Qiu, Man, Institute of Space Medico-Engineering, China; Song, De, Institute of Space Medico-Engineering, China; Yang, Tian-De, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 90-94; In English; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To explore a space craft precooling temperature at which excessive thermal stress on the crew member could be prevented or reduced in an overheated launch or reentry module. Five young male volunteers wearing a space suit participated in 25 tests at sea level. The space suit was either ventilated in a volume air flow rate of 100 L/min (STPD) with ambient air at temperatures ($T_{sub a}$) of 15 C, 10 C, and 5 C, respectively, or not ventilated. Rectal ($T_{sub r}$), mean skin ($T_{bar sub sk}$) and mean body ($T_{bar sub b}$) temperatures were measured. At $T_{sub a}$ 15 C, $T_{sub r}$ decreased without significance (from 37.0 plus or minus 0.3 C to 36.3 plus or minus 0.3 C (P less than 0.05), subjects had a whole body cold strain, and both $T_{bar sub sk}$ and $T_{bar sub b}$ dropped continuously and significantly. Ambient temperature 15 C, at which the thermal comfort states of crew was not significantly degraded, was acceptable after precooling in a spacecraft.

Author

Precooling; Space Suits; Physiological Effects; Manned Spacecraft; Thermoregulation; Aerospace Medicine

20000084130 Institute of Space Medico-Engineering, Beijing, China

A Simulation Study of Cabin Pressure Changes Under Accidental Leakage

Liang, Zhi-Wei, Institute of Space Medico-Engineering, China; Yin, Yong-Li, Institute of Space Medico-Engineering, China; Zhu, Yan-Fang, Institute of Space Medico-Engineering, China; Space Medicine and Medical Engineering; Apr. 2000; ISSN 1002-0837; Volume 13, No. 2, pp. 128-131; In Japanese; Copyright Waived; Avail: CASI; A01, Hardcopy; A01, Microfiche

To study the changes of cabin pressure during accidental leakage. Based on the analysis of the actual conditions of accidental leakage, the overall boundary conditions and the influencing factors, a mathematical model was established, and a computer program is developed for the calculation of the changes of cabin pressure. by comparing the results of calculation with the test data, the mathematical model is verified, and the results of the calculation are highly credible. Using the simulation program, calculation of the changes in the cabin atmosphere pressure is carried out under different conditions, the results are important for the design of the safety rescue system.

Author

Leakage; Aerospace Medicine; Pressurized Cabins; Spacecraft Cabin Atmospheres; Computerized Simulation

20000084328 NASA Johnson Space Center, Houston, TX USA

Nutrition and Foods as Related to Space Flight

Lane, Helen W., NASA Johnson Space Center, USA; Smith, Scott M., NASA Johnson Space Center, USA; Bourland, Charles T., NASA Johnson Space Center, USA; [1999]; 23p; In English; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

U.S. space food development began with highly engineered foods that met rigid requirements imposed by the spacecraft design and short mission durations of the Mercury and Gemini programs. The lack of adequate bathroom facilities and limited food storage capacity promoted the development of low fiber diets to reduce fecal output. As missions lengthened, space food systems evolved, with the most basic design consideration always being the method of water supply. On the Apollo spacecraft, where water was abundant as a byproduct of fuel cell electricity generation, dehydrated food was used extensively. Such food has little advantage when water has to be transported to space to rehydrate it; therefore, more complex food systems were planned for Skylab, which used solar panels rather than fuel cells for electricity generation. The Skylab food system, the most advanced used in space to date, included freezers and refrigerators, increasing the palatability, variety, and nutritional value of the diet. On the Space Shuttle, power and weight constraints precluded the use of freezers, refrigerators, and microwave ovens. The availability of fuel cell by-product water was conducive to a shelf-stable food system with approximately half of the food dehydrated and the remainder made up of thermostabilized, irradiated, and intermediate-moisture foods.

Derived from text

Consumables (Spacecrew Supplies); Space Flight Feeding; Dehydrated Food; Gemini Flights; Skylab Program; Space Shuttles; Nutrition

20000085933 NASA Johnson Space Center, Houston, TX USA

Human Engineering Operations and Habitability Assessment: A Process for Advanced Life Support Ground Facility Testbeds

Connolly, Janis H., NASA Johnson Space Center, USA; Arch, M., NASA Johnson Space Center, USA; Elfezouaty, Eileen Schultz, Lockheed Martin Space Operations, USA; Novak, Jennifer Blume, Lockheed Martin Space Operations, USA; [1999]; 1p; In English; ICES, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): NAS9-18800; Copyright; Avail: Issuing Activity; Abstract Only

Design and Human Engineering (HE) processes strive to ensure that the human-machine interface is designed for optimal performance throughout the system life cycle. Each component can be tested and assessed independently to assure optimal performance, but it is not until full integration that the system and the inherent interactions between the system components can be assessed as a whole. HE processes (which are defining/applying requirements for human interaction with missions/systems) are included in space flight activities, but also need to be included in ground activities and specifically, ground facility testbeds such as Bio-Plex. A unique aspect of the Bio-Plex Facility is the integral issue of Habitability which includes qualities of the environment that allow humans to work and live. HE is a process by which Habitability and system performance can be assessed.

Author

Human Factors Engineering; Plant Design; Man Machine Systems; Life (Durability)

20000085938 NASA Johnson Space Center, Houston, TX USA

Preservation Methods Utilized for Space Food

Vodovotz, Yael, NASA Johnson Space Center, USA; Bourland, Charles, NASA Johnson Space Center, USA; [2000]; 2p; In English; International Congress on Engineering and Food, 9-12 Apr. 2000, Puebla, Mexico; No Copyright; Avail: Issuing Activity; Abstract Only

Food for manned space flight has been provided by NASA-Johnson Space Center since 1962. The various mission scenarios and spacecraft designs dictated the type of food preservation methodologies required to meet mission objectives. The preservation techniques used in space flight include freeze-dehydration, thermostabilization, irradiation, freezing and moisture adjustment. Innovative packaging material and techniques enhanced the shelf-stability of the food items. Future space voyages may include extended duration exploration missions requiring new packaging materials and advanced preservation techniques to meet mission goals of up to 5-year shelf-life foods.

Author

Storage Stability; Packaging; Preserving; Service Life; Dehydrated Food

20000085944 Lockheed Martin Space Operations, Crew and Thermal Systems Div., Houston, TX USA

Advanced Spacesuit Portable Life Support System Packaging Concept Mock-Up Design & Development

O'Connell, Mary K., Lockheed Martin Space Operations, USA; Slade, Howard G., Lockheed Martin Space Operations, USA; Stinson, Richard G., Lockheed Martin Space Operations, USA; 1998; 11p; In English; 29th; ICES, Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): NAS9-19100

Report No.(s): 99-ES-161; Copyright; Avail: Issuing Activity

A concentrated development effort was begun at NASA Johnson Space Center to create an advanced Portable Life Support System (PLSS) packaging concept. Ease of maintenance, technological flexibility, low weight, and minimal volume are targeted in the design of future micro-gravity and planetary PLSS configurations. Three main design concepts emerged from conceptual design techniques and were carried forth into detailed design, then full scale mock-up creation. "Foam", "Motherboard", and "LEGOtm" packaging design concepts are described in detail. Results of the evaluation process targeted maintenance, robustness, mass properties, and flexibility as key aspects to a new PLSS packaging configuration. The various design tools used to evolve concepts into high fidelity mock ups revealed that no single tool was all encompassing, several combinations were complimentary, the devil is in the details, and, despite efforts, many lessons were learned only after working with hardware.

Author

Space Suits; Portable Life Support Systems; Design Analysis

20000085957 NASA Johnson Space Center, Houston, TX USA

Multi-Agent Diagnosis and Control of an Air Revitalization System for Life Support in Space

Malin, Jane T., NASA Johnson Space Center, USA; Kowing, Jeffrey, NASA Johnson Space Center, USA; Nieten, Joseph, LinCom Corp., USA; Graham, Jeffrey s., LinCom Corp., USA; Schreckenghost, Debra, Metrica, Inc., USA; Bonasso, Pete, Metrica, Inc., USA; Fleming, Land D., Hernandez Engineering, Inc., USA; MacMahon, Matt, S and K Electronics, Inc., USA; Thronesbery, Carroll, S and K Electronics, Inc., USA; [2000]; 1p; In English; Aerospace, 18-25 Mar. 2000, Big Sky, MT, USA; Sponsored by Institute of Electrical and Electronics Engineers, USA

Contract(s)/Grant(s): RTOP 632-30-43; No Copyright; Avail: Issuing Activity; Abstract Only

An architecture of interoperating agents has been developed to provide control and fault management for advanced life support systems in space. In this adjustable autonomy architecture, software agents coordinate with human agents and provide support in novel fault management situations. This architecture combines the Livingstone model-based mode identification and reconfiguration (MIR) system with the 3T architecture for autonomous flexible command and control. The MIR software agent performs model-based state identification and diagnosis. MIR identifies novel recovery configurations and the set of commands required for the recovery. The AZT procedural executive and the human operator use the diagnoses and recovery recommendations, and provide command sequencing. User interface extensions have been developed to support human monitoring of both AZT and MIR data and activities. This architecture has been demonstrated performing control and fault management for an oxygen production system for air revitalization in space. The software operates in a dynamic simulation testbed.

Author

Air Purification; Architecture (Computers); Diagnosis; Life Support Systems; Autonomy; Spacecraft Environments

20000086192 NASA Johnson Space Center, Houston, TX USA

Chemical Analysis and Water Recovery Testing of Shuttle-Mir Humidity Condensate

Mudgett, Paul D., Wyle Labs., Inc., USA; Straub, John E., II, Wyle Labs., Inc., USA; Schultz, John R., Wyle Labs., Inc., USA; Sauer, Richard L., NASA Johnson Space Center, USA; Williams, David E., NASA Johnson Space Center, USA; Bobe, L. S., Nauchno-Proizvodstvennoe Obedinenie Niichimmash, USSR; Novikov, V. M., Nauchno-Proizvodstvennoe Obedinenie Niichimmash, USSR; Andreichouk, P. O., RSC-Energia, Russia; Protasov, N. N., RSC-Energia, Russia; [1999]; 9p; In English Report No.(s): SAE-1999-01-2029; Copyright; Avail: Issuing Activity

Humidity condensate collected and processed in-flight is an important component of a space station drinking water supply. Water recovery systems in general are designed to handle finite concentrations of specific chemical components. Previous analyses of condensate derived from spacecraft and ground sources showed considerable variation in composition. Consequently, an investigation was conducted to collect condensate on the Shuttle while the vehicle was docked to Mir, and return the condensate to Earth for testing. This scenario emulates an early ISS configuration during a Shuttle docking, because the atmospheres intermix during docking and the condensate composition should reflect that. During the STS-89 and STS-91 flights, a total volume of 50 liters of condensate was collected and returned. Inorganic and organic chemical analyses were performed on aliquots of the fluid. Tests using the actual condensate were then conducted with scaled-down elements of the Russian condensate recovery system to determine the quality of water produced. The composition and test results are described, and implications for ISS are discussed.

Author

Chemical Analysis; Water Reclamation; Evaluation; Mir Space Station; Humidity; Condensates

20000088543 NASA Johnson Space Center, Houston, TX USA

Fire and Ice - Safety, Comfort, and Getting the Firefighters' Job Done

Foley, Tico, NASA Johnson Space Center, USA; Butzer, Melissa, Oceaneering Space Systems, USA; [1999]; 4p; In English; 43rd;

Human Factors and Ergonomics Society, 27 Sep. - 1 Oct. 1999, Santa Monica, CA, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Daily life for firefighters consists of working with life-threatening hazards in hostile environments. A major hazard is excessive ambient heat. New hazards have arisen from protective gear that was intended to increase survival time of firefighters while finding and rescuing victims. The insulation is so good now that a firefighter's metabolic heat buildup cannot escape. This forces body core temperatures to life threatening levels in about 20 minutes of moderate activity. Using NASA space suit technology, Oceaneering Space Systems developed a liquid cooling garment prototype that will remove up to 250 watts of metabolic heat. After testing and certification as an approved accessory for firefighter use, this garment will be available for use by any individual encapsulated in protective clothing. This demonstration will present a high surface area circulated liquid cooling garment displayed on a mannequin and available for attendees to try on to experience the effects of active cooling.

Author

Garments; Liquid Cooling; Protective Clothing; Fire Fighting; Cooling Systems

20000088572 Army Aeromedical Research Lab., Fort Rucker, AL USA

Variability of Eye Positions with EPS-21 Sun, Wind, and Dust Goggle *Final Report*

McLean, William E.; Jun. 2000; 29p; In English

Report No.(s): AD-A379756; USAARL-2000-17; No Copyright; Avail: CASI; A03, Hardcopy; A01, Microfiche

Methods for providing advanced spectacle and goggle laser protection for visible lasers include reflective dielectric coatings and holograms, tuned for specific wavelengths. The primary advantage of these methods compared to the current fielded broad band absorptive dyes is the potential for increased visual transmission for a given amount of protection. However, dielectric coatings and holograms are angle and position sensitive such that the locations of the eye positions are critical for the desired protective effects. This study measured the right and left eye positions (lateral (x), vertical (y), and fore-aft (z)) of 20 military subjects fixating straight ahead while wearing an EPS-21 Sun, Wind, and Dust goggle using mechanical methods. The lateral and vertical eye positions were also determined using a reflective method for rapid data acquisition. The reflections from the goggle lens and eyes were captured with a digital camera and analyzed with a computer program. The results showed that the eye positions measured mechanically for this sample varied similarly about the x, y, and z axes.

DTIC

Goggles; Variability; Eye (Anatomy); Protective Clothing; Safety Devices; Eye Protection

20000088613 Lockheed Martin Space Operations, Space Architect, Houston, TX USA

Habitability as a Tier One Criterion in Exploration Mission and Vehicle Design, Part 1, Habitability *Final Report*

Adams, Constance M., Lockheed Martin Space Operations, USA; McCurdy, Matthew Riegel, Texas A&M Univ., USA; [1999]; 16p; In English; ICES, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA

Contract(s)/Grant(s): RTOP 953--74-00

Report No.(s): 1999-01-2137; Copyright; Avail: Issuing Activity

Habitability and human factors are necessary criteria to include in the iterative process of Tier I mission design. Bringing these criteria in at the first, conceptual stage of design for exploration and other human-rated missions can greatly reduce mission development costs, raise the level of efficiency and viability, and improve the chances of success. In offering a rationale for this argument, the authors give an example of how the habitability expert can contribute to early mission and vehicle architecture by defining the formal implications of a habitable vehicle, assessing the viability of units already proposed for exploration missions on the basis of these criteria, and finally, by offering an optimal set of solutions for an example mission. In this, the first of three papers, we summarize the basic factors associated with habitability, delineate their formal implications for crew accommodations in a long-duration environment, and show examples of how these principles have been applied in two projects at NASA's Johnson Space Center: the BIO-Plex test facility, and TransHab.

Author

Habitability; Spacecraft Cabins; International Space Station; Space Habitats

20000088652 Lockheed Martin Corp., Houston, TX USA

Item Description: ISS TransHab Restraint Sample and Photo Documentation

Adams, Constance, Lockheed Martin Corp., USA; [2000]; 5p; In English; Space Architecture, 1 Feb. 2000, Chicago, IL, USA

Contract(s)/Grant(s): NAS9-18800; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

The yellow strap seen in the display is a piece of the main restraint layer of a test article for the ISS TransHab spacecraft, First conceived as a technology which is capable of supporting a [human] crew of six on an extended space journey such as the six-month trip to Mars, TransHab (short for "Transit habitat") is the first space inflatable module ever designed. As this text is

written it is being considered as a replacement for the Habitation module on the International Space Station (ISS). It constitutes a major breakthrough both in technology and in tectonics: capable of tight packaging at light weight for efficient launch, the vehicle can then be inflated to its full size on orbit via its own inflation tanks. This is made possible by the separation of its main structural elements from its pressure-shell. In other words, all spacecraft flown to date have been of an exoskeletal type---i.e., its hard outer shell acts both as a pressure container and as its main channel for structural loading. This includes the ISS, which is currently under construction in Low Earth Orbit [275 miles above the Earth]. by contrast TransHab is the first endoskeletal space Habitat, consisting of a dual system: a light, reconfigurable central structure of graphite composite and a multilayered, deployable pressure shell.

Derived from text

Habitats; Manned Mars Missions; Interplanetary Spacecraft; Manned Spacecraft; Space Capsules

20000090525 NASA Johnson Space Center, Houston, TX USA

A Second-Generation Volatile Organic Analyzer for the International Space Station

Limero, Thomas, Wyle Labs., Inc., USA; Reese, Eric, Wyle Labs., Inc., USA; Peters, Randy, Wyle Labs., Inc., USA; James, John T., NASA Johnson Space Center, USA; [1999]; 1p; In English; Environmental Systems, 12-15 Jul. 1999, Denver, CO, USA; Sponsored by Society of Automotive Engineers, Inc., USA; No Copyright; Avail: Issuing Activity; Abstract Only

Early in the development of the Crew Health Care System (CHECS) for the International Space Station (ISS), it was recognized that detection of target volatile organic compounds would be a key component of the air monitoring strategy. Experiences during the NASA/Mir program supported the decision to include a real-time volatile organic analyzer (VOA) aboard ISS to help assess the impact of air quality events on crew health and determine the effectiveness of decontamination efforts. Toward this end, a joint development by the Toxicology Laboratory at Johnson Space Center and Graseby Dynamics produced a VOA that has been delivered and is ready for the first 5 years of ISS operation. The first-generation VOA selection criteria included minimizing size, weight, and power consumption while maintaining analytical performance. Measuring available technologies against these criteria, a VOA system based upon gas chromatography/ion mobility spectrometry (GC/IMS) was selected in the mid-90's. However, as NASA looks forward to later-stage ISS operations and to new frontiers such as human exploration of Mars, the ISS VOA (weighing 43 kg and consuming 160 watts) must be replaced by a smaller, less resource-intensive device. This paper will present a possible second-generation VOA based upon the same technology as the first-generation unit. Utilizing GC/IMS technology again will permit the instrumental data and experience gained during the initial phase of ISS to be applied to later ISS phases and advanced spacecraft missions. During the past 3 years, efforts to reduce the size of ion mobility spectrometers have been pursued by Graseby Dynamics, the manufacturer of the first-generation VOA. The concept of operation, expected analytical performance, and estimated size of a fully functional second-generation VOA based upon GC/mini-IMS technology will be presented. Furthermore, results of initial laboratory evaluations will be shown.

Author

Air Quality; Detection; Environmental Monitoring; International Space Station; Volatile Organic Compounds; Spacecraft Environments

20000091044 Air Force Research Lab., Human Effectiveness Directorate, Brooks AFB, TX USA

Testing and Evaluation of the International Biomedical, Inc., Model 185M, Airborne Life Support System *Final Report*

Blake, Butch O.; Jun. 2000; 18p; In English

Contract(s)/Grant(s): Proj-7184

Report No.(s): AD-A379463; AFRL-HE-BR-TR-2000-0066; No Copyright; Avail: CASI; A01, Microfiche; A03, Hardcopy

The International Biomedical, Inc., Model 185M, Airborne Life Support System (ALSS) is an infant transport incubator. It provides an environment to sustain an infant's life support requirements while being transported. The ALSS's standard infant chamber circulates heated air and comes equipped with one main door, one head door, and two hand ports. The ALSS's main door allows access for infant placement inside the infant chamber as well as further access for medical care. to prevent excessive heat loss, the main door has hand ports to allow infant care without opening the main door. The ALSS provides medical grade oxygen using "B" size tanks secured underneath the unit. The unit operates off of 115 VAC/60 and 400 Hz and internal rechargeable battery. The unit weighs approximately 86.9 lbs. Its dimensions are 40.0 in. W. X 19 5/8 in. H. X 22 1/2 in. D.

DTIC

Life Support Systems; Medical Services; Medical Equipment

20000093325 NASA Johnson Space Center, Houston, TX USA

Dynamic Modeling of The Minimum Consumables PLSS

Campbell, Anthony B., Missouri Univ., USA; French, Jonathan D., Missouri Univ., USA; Nair, Satish S., Missouri Univ., USA;

Miles, John B., Missouri Univ., USA; [1999]; 12p; In English; 29th; 29th International Conference on Environmental Systems, 12-15 ul. 1999, Denver, CO, USA

Contract(s)/Grant(s): NAG9-915; PWC-260981; Copyright; Avail: Issuing Activity

A transient model of the Minimum Consumables Portable Life Support System (MPLSS) Advanced Space Suit design has been developed and implemented using MATLAB/Simulink. The purpose of the model is to help with sizing and evaluation of the MPLSS design and aid development of an automatic thermal comfort control strategy. The MPLSS model is described, a basic thermal comfort control strategy implemented, and the thermal characteristics of the MPLSS Advanced Space Suit are investigated.

Author

Dynamic Models; Design Analysis; Space Suits; Consumables (Spacecrew Supplies); Space Logistics; Portable Life Support Systems

20000093972 Naval Postgraduate School, Monterey, CA USA

Human Factors Analysis of Fiscal Year 90 to 97 Rotary Wing and TACAIR Flight Mishaps

Denham, Kenneth R.; Jun. 2000; 116p; In English

Report No.(s): AD-A379445; No Copyright; Avail: CASI; A06, Hardcopy; A02, Microfiche

Human error is present in approximately 60 to 80 percent of all Naval Aviation (NA) flight mishaps (FMs). This indicates a need to identify the patterns and relationships of human error associated with NA FMs in order to develop tailored intervention strategies. This study uses the Human Factors Analysis and Classification System (HFACS), a human error oriented accident investigation and analysis process, to conduct post-hoc analysis of 77 rotary wing and 141 Tactical Aircraft (TACAIR) Class A and B human error FMs from Fiscal Year 90 to 97. This study indicates that Skill-Based Error, Decision Error, Adverse Mental State (AMS) and Crew Resource Management (CRM) are the predominant human error types associated with NA FMs. A nonparametric bootstrap simulation is performed for singular and combinations of human error types to develop the most effective intervention strategies. For the rotary wing community, the CRM human error type represents the best target for selected intervention strategies and potential cost savings. The AMS human error type provides the best target for selected intervention strategies and potential cost savings for the TACAIR community. The use of flight simulators is viewed as the most effective intervention strategy for both predominant human error types identified.

DTIC

Human Factors Engineering; Error Analysis; Aircraft Accidents; Rotary Wings; Accident Investigation

20000094217 Texas Univ., Austin, TX USA

Automated Construction of a Martian Base

Braun, Angela Nicole, Texas Univ., USA; Butler, Dan Bordeaux Burk, Texas Univ., USA; Kirk, Benjamin Shelton, Texas Univ., USA; White, Scott William, Texas Univ., USA; Third Annual HEDS-UP Forum; 2000, pp. 44-56; In English; See also 20000094214; No Copyright; Avail: CASI; A03, Hardcopy; A03, Microfiche

This document describes the construction of a Martian base that will support human exploration. The base will be constructed without a human presence in order to minimize the risk to the crew. The base will be verified remotely before the crew leaves Earth to ensure that all systems are performing as expected. Life support is the most obvious function the base will have to perform. The crew will require consumables such as food and water. They must also be provided with a controlled atmosphere. The base will use in-situ resource generation (ISRG) as the primary means to provide these services. The ISRG system will extract chemicals from the Martian atmosphere and convert them to usable resources. Power is a key resource for the base. The primary power needs will be met by an SP-100 nuclear reactor and three Stirling engines. This primary power source can provide 375 kW of power under nominal conditions, which is sufficient to support all base operations. Backup systems are present that can sustain critical functions such as life support and communications in the case of primary system failure. The base will provide a substantial communications infrastructure. Both Earth to Mars and surface communications are supported. A satellite constellation will be used to provide this capability. Backup systems are also provided that can be used in the event of primary system failure. Surface operations and science capability is an important aspect of the base design. The base includes two primary laboratories. One laboratory is contained in a lab module that is stationary, and the other is part of a pressurized rover. This mobile science unit (MSU) gives the exploration team the capability of collecting samples and exploring geologic features up to 500 km away. The MSU can operate autonomously from the base for periods up to two weeks with a crew, or it can function robotically for longer periods of time. A transportation and delivery scheme has also been developed. This scheme requires 4 cargo and assembly missions. The cargo modules will transfer from Earth to Mars on a low energy, near-Hohmann trajectory and then aerocapture into Martian orbit. The cargo modules will then descend to the Martian surface and land within 1km of the chosen landing site. Each cargo module can land up to 15 metric tons on the surface. Construction will begin as soon as the cargo modules land. The

first launch opportunity will send the power and resource generation systems for the base as well as the surface communications infrastructure and two unpressurized rovers in a single launch package. Resource generation will begin as soon as possible. The second launch package will contain the water extraction system, an ascent vehicle, and scientific equipment and instruments. The remainder of the base will arrive with the second launch opportunity. The first cargo mission in this opportunity will transport the science and utility modules and a pressurized science rover to the surface. The final launch will contain the habitation module, crew consumables, and a supplemental life support system. Base assembly is accomplished through component movement and integration. This work is accomplished primarily with the two unpressurized rovers. The assembly procedure is controlled from the surface with the help of artificial intelligence. The final base is comprised of a central hub, three inflatable utility modules, the power system, and the ascent module. The base is validated using telemetry from each subsystem. The validation must be successfully completed before sending a crew to Mars.

Author

Construction; Life Support Systems; Mars (Planet); Mars Surface; Mars Bases; Extraterrestrial Environments; Space Habitats; Extraterrestrial Resources; Space Logistics

20000094308 NASA Johnson Space Center, Houston, TX USA

Critical Path Web Site

Robinson, Judith L., NASA Johnson Space Center, USA; Charles, John B., NASA Johnson Space Center, USA; [2000]; 1p; In English

Contract(s)/Grant(s): NAS9-97166; No Copyright; Avail: Issuing Activity; Abstract Only

Approximately three years ago, the Agency's lead center for the human elements of spaceflight (the Johnson Space Center), along with the National Biomedical Research Institute (NSBRI) (which has the lead role in developing countermeasures) initiated an activity to identify the most critical risks confronting extended human spaceflight. Two salient factors influenced this activity: first, what information is needed to enable a "go/no go" decision to embark on extended human spaceflight missions; and second, what knowledge and capabilities are needed to address known and potential health, safety and performance risks associated with such missions. A unique approach was used to first define and assess those risks, and then to prioritize them. This activity was called the Critical Path Roadmap (CPR) and it represents an opportunity to develop and implement a focused and evolving program of research and technology designed from a "risk reduction" perspective to prevent or minimize the risks to humans exposed to the space environment. The Critical Path Roadmap provides the foundation needed to ensure that human spaceflight, now and in the future, is as safe, productive and healthy as possible (within the constraints imposed on any particular mission) regardless of mission duration or destination. As a tool, the Critical Path Roadmap enables the decisionmaker to select from among the demonstrated or potential risks those that are to be mitigated, and the completeness of that mitigation. The primary audience for the CPR Web Site is the members of the scientific community who are interested in the research and technology efforts required for ensuring safe and productive human spaceflight. They may already be informed about the various space life sciences research programs or they may be newcomers. Providing the CPR content to potential investigators increases the probability of their delivering effective risk mitigations. Others who will use the CPR Web Site and its content include program managers and administrators who track the program and are involved in decisions regarding resource allocation and program evaluation.

Author

Decision Making; Risk; Space Flight; World Wide Web; Human Tolerances; Bioastronautics

20000094314 NASA Johnson Space Center, Houston, TX USA

Evaluation of Contaminant-Promoted Ignition in Scuba Equipment and Breathing Gas Delivery Systems

Forsyth, Elliott T., Allied-Signal Technical Services Corp., USA; Durkin, Robert, NASA Johnson Space Center, USA; Beeson, Harold D., NASA Johnson Space Center, USA; [2000]; 1p; In English; 9th; Flammability and Sensitivity of Materials in Oxygen-Enriched Atmospheres, 28-29 Sep. 2000, Paris, France; Sponsored by American Society for Testing and Materials, USA Contract(s)/Grant(s): NAS9-95682; No Copyright; Avail: Issuing Activity; Abstract Only

As the underwater diving industry continues to use greater concentrations of oxygen in their scuba systems, ignition of contaminants in these systems becomes a greater concern. Breathing gas makeup and distribution systems typically combine pure oxygen with various diluents to supply high-pressure cylinders for scuba applications. The hazards associated with these applications of oxygen and NITROX (oxygen and nitrogen mixture) gases require an evaluation of inherent contaminant levels and their associated promoted-ignition thresholds in these environments. In this study, several scuba component assemblies were tested after one year of use at the NASA Johnson Space Center Neutral Buoyancy Lab. The components were rapidly impacted with 50% NITROX gas to demonstrate their ignition resistance, then disassembled to evaluate their cleanliness. A follow-up study was then performed on the ignition thresholds of hydrocarbon-based oil films in oxygen and NITROX environments in an attempt to define the cleaning requirements for these systems. Stainless steel tubes were contaminated and verified to known levels and

placed in a pneumatic impact test system where they were rapidly pressurized with the test gas. Ignitions were determined using a photodiode connected to the end of the contaminated tube. The results of the scuba component tests, cleanliness evaluation, and contaminant ignition study are discussed and compared for 50% NITROX and 100% oxygen environments.

Author

Breathing Apparatus; Contaminants; Diving (Underwater); Ignition; Gas Mixtures

55 EXO BIOLOGY

Includes astrobiology; planetary biology; and extraterrestrial life. For the biological effects of aerospace environments on humans see 52 Aerospace medicine; on animals and plants see 51 Life Sciences. For psychological and behavioral effects of aerospace environments see 53 Behavioral Science.

20000085548 NASA Johnson Space Center, Houston, TX USA

Possible Evidence for Life in ALH84001

McKay, David, NASA Johnson Space Center, USA; Gibson, Everett K., Jr., NASA Johnson Space Center, USA; Thomas-Keprta, Kathie, Lockheed Martin Engineering and Science Services, USA; [1999]; 4p; In English; 5th; Mars, 18-23 Jul. 1999, Pasadena, CA, USA

Contract(s)/Grant(s): RTOP 344-38-11-01; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

Since our original paper Science in August 1996, considerable new data has appeared from laboratories throughout the world, and our own team has had a chance to examine the sample in greater detail. The following summary touches on our original data and interpretation, and points out new data from us and from other groups, and the resulting changes and refinements in interpretations which we have made during the past three years.

Author

Data Acquisition; Life Sciences

20000085882 NASA Goddard Space Flight Center, Greenbelt, MD USA

Cooperative Robotics and the Search for Extraterrestrial Life

Lupisella, Mark L., NASA Goddard Space Flight Center, USA; [2000]; 2p; In English; Mars Re-Planning, 18-19 Jul. 2000, Houston, TX, USA; No Copyright; Avail: CASI; A01, Hardcopy; A01, Microfiche

If we think tenuous abodes of life may be hiding in remote extraterrestrial environmental niches, and if we want to assess the biological status of a given locale or entire planet before sending humans (perhaps because of contamination concerns or other motivations) then we face the challenge of robotically exploring a large space efficiently and in enough detail to have confidence in our assessment of the biological status of the environment in question. On our present schedule of perhaps two or so missions per opportunity, we will likely need a different exploratory approach than singular stationary landers or singular rover missions or sample return, because there appear to be fundamental limitations in these mission profiles to-obtain the many samples we will likely need if we want to have confidence in assessing the biological status of an environment in which life could be hiding in remote environmental niches. Singular rover missions can potentially accommodate sampling over a fairly large area, but are still limited by range and can be a single point of failure. More importantly, such mission profiles have limited payload capabilities which are unlikely to meet the demanding requirements of life-detection. Sample return has the advantage of allowing sophisticated analysis of the sample, but also has the severe limitations associated with only being able to bring back a few samples. This presentation will suggest two cooperative robotic approaches for exploration that have the potential to overcome these difficulties and facilitate efficient and thorough life-detecting exploration of a large space. Given the two premises state above, it appears at least two fundamental challenges have to be met simultaneously: coverage of a large space and bringing to bear a sophisticated suite of detection and experimental payloads on any specific location in order to address a major challenge in looking for extraterrestrial life: namely, executing a wide variety of detection scenarios and in situ experiments in order to gather the required data for a confident assessment that life has been detected and to, more generally, cover a wide range of extraterrestrial life possibilities. Cooperative robotics lends itself to this kind of problem because cooperation among the combined capabilities of a variety of simple single function agents can give rise to fairly complex task execution such as the search for and detection of extraterrestrial life.

Derived from text

Extraterrestrial Life; Robotics; Contamination; Detection; Mission Planning

Subject Term Index

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